The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. XL. April 8, 1939 No. 1,032

Physics in Industry

THE importance to every branch of the national life of the work of the National Physical Laboratory is too well recognised to require emphasis. Even the most apparently unscientific of industries benefit indirectly from this work, and its effect on the technique of those, such as the chemical industry, which are directly concerned with the application of science, is profound. It is profound, however, only insofar as the reports are studied, the facilities of the laboratory are used, and the results are applied to industrial operations by those engaged in industry. The performance of scientific work is one thing; its application to practice is the complement without which the work is useless. So far as can be gathered from the 1938 Report of the N.P.L., just issued, there is no lack of application of results, and in that respect the N.P.L. is more happily placed than some other research bodies. An instance of this is the determination of the temperature of molten steel, a factor that indirectly affects chemical engineering in its effect on the quality of steel. There has been difficulty in determining the temperature of molten steel in the furnace, the only logical place since there alone is the temperature controllable, and when a pyrometer is sighted on the flowing metal, the low emissivity of the surface may involve a correction of 150° C. A method has now been found based on the immersion for less than 15-20 seconds of a thermocouple in a light silica sheath, which can be used up to 1,690° C. The report adds that the N.P.L. apparatus for this purpose "is now in regular use at the steel works in Sheffield where the experiments were carried out and similar apparatus is on trial at several other works."

Many examples are found in the Report of researches having specific application to industrial problems and investigations are undertaken on a repayment basis for industry and for private individuals. Among these has been the determination of the lower explosive limits of acetone-air-water-vapour mixtures, tests on filtering materials, corrosion fatigue tests on metals, bursting pressure tests, tests on pressure gauges, flow meters and an automatic gas valve, to mention only a few. In addition, advice not requiring experimental work is given free of charge. The Executive Committee express the hope that industry will also take full advantage of the unique facilities which are available for all branches of precise measurement; as an instance of this work is the design or checking of gauges for mass production. The variation in gauges may lead to quite serious consequences as, for example, in large screwed pipes where the pipes made by different makers, or even by the same maker at intervals of some months, may not fit on account of minute differences in the gauges or on account of wear during use of the tools.

Among the interesting subjects noted in reading this year's Report is the attention being paid to acoustics for all purposes and, in particular, to the elimination of noise. This work is an indirect contribution to industrial efficiency. For high-temperature calibration of thermocouples the freezing points of platinum (1,773° C.) and iridium (2,450° C.) are available, and in addition the N.P.L. has now confirmed the U.S. Bureau of Standards figure for rhodium of 1,965° C. It has been ascertained that alloying iron leads to reduction of the thermal conductivity, while up to 300° C. the temperature coefficient is negative for steels of high conductivity, zero for those of medium conductivity, and positive for those of low conductivity. The specific heats of a group of eight carbon steels from the eutectoid composition of 0.85 up to 1.2 per cent. of carbon have been found to progress regularly with temperature from 0.116 at 50° C. to 0.18 at 580° C. The fatigue failures of metals has been correlated with the structure; below a critical stress there was found to be very little change in the structure, no matter how often the stress was applied, but above this value there was increasing fragmentation of the crystallites of the material until when fracture occurred there was, in addition, heavy lattice distortion. Outside the safe range, a single crystal of aluminium subjected to alternating stresses was found to be dispersed into crystallites of widely differing orientation. The generation of static electricity during dry cleaning has been diminished by the use of special soaps which increase the electrical conductivity of the cleaning solvents, and an instrument has been devised for the ascertainment of adequate conductivities. A new high-precision balance enables kilogram standard weights to be weighed with an accuracy of 0.001 mgm., or one part per 1,000,000,000. Investigations of welding for pressure vessels has led to the conclusion that none of the welds was quite equal to the unwelded plates, but some of those obtained were very little inferior.

> *It appears to be insufficiently appreciated at present that a highly efficient and economic performance has been obtained in various forms of transport by the substitution of producer gas for Diesel oil and petrol. . . . Is it not high time that encouragement—yes, and assistance where necessary—should be given to industry as a whole to adopt this fuel, derived from our own coal, wherever possible. . . .*
>
> —*Lord Ailwyn.*

NOTES AND COMMENTS

The Anniversary Meetings of the Chemical Society

THIS year's anniversary meetings of the Chemical Society were held in London, and took place on Wednesday, Thursday and Friday of last week. The proceedings opened with the Rutherford Memorial Lecture, delivered by Sir Henry Tizard at the Royal Institution. It was a most excellent address and a model memorial lecture. It was no dry catalogue of work done, a form of presentation which must be difficult to avoid in a memorial lecture, but the *significance* of the late Lord Rutherford's achievements was described, harmoniously combined with a clear impression of the wonderful character and genius of the man himself. On Wednesday evening Fellows and guests were entertained at a reception and dance at Imperial Chemical House. On the morning of the following day visits to Bedford College for Women and the Wellcome Research Institution were made and in the afternoon the annual general meeting was held. This was followed by Professor F. G. Donnan's presidential address on " The Role of Osmotic Pressure in the Development of Chemical and Biochemical Science," extracts from the address and from the Rutherford Memorial Lecture are published in this issue. The Socety's anniversary dinner was held at Grosvenor House in the evening. Another most successful meeting was brought to a close on Friday by visits to works and laboratories.

Increasing Industrial Activity

THE Ministry of Labour figures issued on Tuesday show a large decrease in unemployment and increase in employment in the last two months. The figure of 12,403,000 for the number of insured persons at work at March 13 last is larger by 181,000 than the figure for February, and an almost equal gain on the figure for March, 1938. This improvement was, moreover, spread over almost every industry, and was widespread throughout the country, each of the Ministry's divisional returns showing a substantial decrease in unemployment. There could be no more certain sign of the increasing activity of industry. This activity has steadily grown during the past few months, and the general prospect is that it will so continue. All this has taken place during most uncertain times and is a sure confirmation of the correctness of the view of those who have refused to listen to the " jitterbug's " nonsense.

More Interesting Sulphanilamide Derivatives

ALTHOUGH sulphanilamide (para-amino-benzene-sulphonamide) has been proved to possess truly remarkable curative power in streptococcal infections, it is only effective in comparatively large doses when its toxic properties might become serious. For some years past a vast amount of research has been carried out in all parts of the world on the derivatives of sulphanilamide with the object of finding materials of chemotherapeutic activity at least equal to that of sulphanilamide but of lower toxicity; a number of derivatives have been described in the literature (and some of them have been produced for sale) as having these desirable characteristics. Two papers presented before the Division of Medicinal Chemistry at this week's meeting of the American Chemical Society describe further interesting sulphanilamide derivatives. The first paper, by Dr. George W. Raiziss and others, describes investigations of sulphones of similar structural arrangement to sulphanilamide. While sulphanilamide contains one benzene ring attached to the characteristics sulphonamide group (SO_2NH_2), 4,4'-diamino-diphenyl-sulphone is characterised by the presence of the sulphone group (SO_2) attached to two benzene rings. In both products the same grouping is present, namely, a benzene ring to which is attached both an amino and a sulphone group. This product has a therapeutic efficiency considerably higher than that of sulphanilamide. However, since the toxicity is greater than that of sulphanilamide the chemical structure was further modified. Leaving the sulphone group intact, one amino group was replaced by a hydroxyl, which resulted in the preparation of 4-amino-4'-hydroxy-diphenyl-sulphone. The last chemical compound proved to be very active therapeutically, and yet less toxic than the original diamino-diphenyl-sulphone.

Outstanding Properties of N_1-Dodecanoyl Sulphonamide

THE second paper, by Dr. M. L. Crossby and others, states that of the many sulphanilamide derivatives prepared, the compound N_1-dodecanoyl sulphonamide was the most outstanding. Studies on experimental animals showed it to have a definite superiority to sulphanilamide in treating streptococcal infections and tuberculosis, coupled with a low order of toxicity. One of the characteristics of the dodecanoyl product is its high degree of fat solubility as compared with sulphanilamide and this is useful in penetrating the fatty pellicle coating the tubercle bacillary which is impervious to a large number of chemotherapeutic agents. It is pointed out that the drug does not cure tuberculosis but rather acts to arrest the spread of the infection. It should be added that these investigations determined the effect of the respective drugs in experimental infections in animals only.

Strength of National Income a Tribute to Industry

NOTWITHSTANDING two major European crises, the first in September and the second in March, the British financial year positively ends with a surplus, the national income exceeding the expenditure by £505,315. Technically there was a deficit because these figures do not include over £13,000,000 provided for sinking funds. When, however, the Exchequer is borrowing heavily for national needs, in this case rearmament, provision for sinking funds loses most of its meaning. The net figures are those that count and they are above all things a remarkable tribute to the steadiness of British finance and industry in the face of appallingly difficult factors. The figures are important in their bearing on the Budget for the coming financial year which Sir John Simon will open towards the end of this month. If the yield of revenue can be maintained at the same level as in 1938-39, the Budget will balance without any fresh taxation. As it is confidently expected that the Chancellor of the Exchequer will not make any addition to the present rate of income tax and National Defence Contribution, such changes as it may be found necessary to make will probably be limited to indirect taxation, and more particularly to further incursions into the luxury field. How successfully the politician has been able to lean on the industrialist is shown by the first receipts in a full year for National Defence Contribution. The total figure is actually £21,890,000, or a third of the entire yield of surtax. Nothing could better illustrate the determination of the country to back the Government in every measure deemed necessary for securing the defence of the Empire.

The Rutherford Memorial Lecture:

Lord Rutherford: His Life and Influence on Chemistry*

By
SIR HENRY T. TIZARD, K.C.B., F.R.S.

Sir Henry Tizard.

RUTHERFORD came to Cambridge in 1895 with an 1851 Exhibition. He was then twenty-four years of age, robust, full of energy and confidence, and endowed with a fighting spirit that never left him. Rutherford's first work in Cambridge was to continue the researches on the detection of electrical waves that he had started in New Zealand. He developed a magnetic detector with which, within a year, he was able to receive signals at a distance of half a mile. He described and demonstrated this at the meeting of the British Association at Liverpool in 1896. Marconi, who was present and who had been experimenting with a vertical aerial on Salisbury Plain, afterwards improved Rutherford's detector for practical use. I mention the episode, not because it has any particular importance to chemists, but because of its historical interest in indicating the probable trend of Rutherford's career if a great fate had not been reserved for him. As it was, the discovery of X-rays and of the radioactivity of uranium within a few months of his arrival in England determined his life's work, and ushered in what he afterwards called the heroic age of physics.

In the early part of 1896 Rutherford started working with Thomson on the ionisation of gases by X-rays, and on the rate of combination of the ions. The great interest of this work now is that it contains the essence of the methods by which he subsequently unravelled the problems of radioactivity. Rutherford was working on this subject during the remainder of 1896 and the whole of 1897. He then went on to examine by similar methods the electrical conduction caused by uranium radiation. It had already been observed that X-rays are in general complex, and include rays of widely different penetrating properties. In the simplest possible way Rutherford showed that the radiation from uranium consisted of at least two types: one, which he called the alpha ray, which was very readily absorbed; and another, which he called the beta ray, of a more penetrating character.

His Work at McGill University

In 1898, at the early age of 27, he was appointed Professor of Physics at McGill University, Montreal, and sailed for Canada in September. By the time he left, the discovery of the electron by J. J. Thomson had provided the first definite indication that all the different kinds of matter might have a common origin. When Rutherford went to Canada the origin of the radiation emitted by uranium compounds was still a complete mystery, and indeed remained so until he and Soddy put forward the famous disintegration theory in 1902.

I think that no papers are more illustrative of his genius, when we take into account his age, the baffling nature of the subject, and the equipment at his disposal, than those he published on thorium radiation within a year after his arrival at McGill. In a series of simple experiments he showed that thorium gave off a kind of gas or emanation, which could be blown along a tube by a slow current of air, and detected in a testing vessel by the conductivity it produced. He showed, too, that any solid object in contact with the emanation became temporarily radioactive, and that this temporary activity decayed to half its value in about eleven hours irrespective of the nature of the surface. If metal surfaces exposed to the emanation were charged negatively, this induced radioactivity tended to concentrate on them. He made a fine platinum wire very active in this way, and then showed that it lost most of its activity when dipped into dilute sulphuric acid. Finally he evaporated the sulphuric acid to dryness and found that the dry glass surface was strongly active. Hence the radioactivity was not destroyed, and the only satisfactory explanation of the observations was that thorium closely evolved a minute quantity of radioactive gas, which then deposited particles of matter of a different degree of radioactivity on surfaces with which it came in contact. It was this investigation that really gave him the clue to his subsequent work which led to the disintegration theory; and this was the first time in which chemical experiments were made with a quantity of matter less than one-billionth of that which could be detected by the most delicate balance.

The Disintegration Theory

Soon after Soddy arrived in Montreal as a lecturer in the Department of Chemistry, and began that fruitful association with Rutherford which was to end in results so surprising and at first so unacceptable to chemists. In a series of what now seem simple investigations they showed that radioactivity must be an atomic phenomenon accompanied by the continuous production of new types of matter with distinctive chemical properties. The only reasonable explanation was that radioactive elements must be undergoing spontaneous transformation. In the light of their results they put forward the suggestion that the presence of helium in minerals containing uranium and thorium must be connected with their radioactivity. There was no evidence at this state to identify the alpha particle with helium. Soddy went back to England in 1903, and he and Ramsay conclusively proved, by spectroscopic evidence, that helium was a product of the disintegration of radium emanation.

Rutherford and Soddy's work was predominantly chemical in character. Indeed this is true of a large part of Rutherford's researches in Canada. The electrometer was merely the physical instrument used to detect and identify infinitesimal quantities of different kinds of radioactive matter. It was not therefore at all inappropriate that when he received the Nobel Prize in 1908 it was given for his researches in chemistry.

The Theory Established

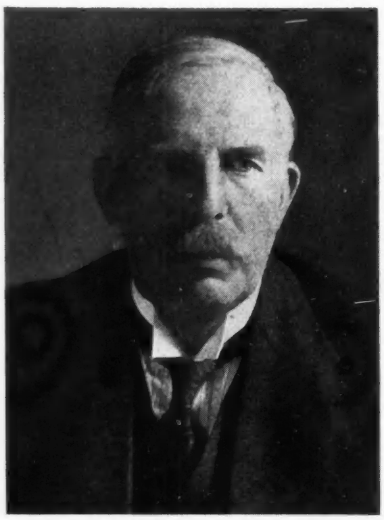
Needless to say the revolutionary theory of the spontaneous disintegration of atoms did not escape severe criticism. After this lapse of time we can at least be as gentle with Rutherford's critics as he was. What is noteworthy is the way Rutherford dealt with the situation. He marshalled all his evidence, direct and circumstantial, with the skill of a great lawyer, and drove his points home one by one until he got a unanimous verdict. Later on, when he was at the height of his fame, I think we got to regard Rutherford as someone to whom nature had imparted her secrets in a mysterious way,

*Extracts from the Lecture delivered at the Royal Institution on March 29 during the Anniversary Meetings of the Chemical Society

and that as he knew the answer to any problem beforehand it was comparatively easy to devise the experiment to prove it. This is far from the truth. He had to grope his way like anyone else, and his consistent success was due in the main to hard work and brilliant experiment; to his exceptional insight and imagination he added an infinite capacity for taking pains.

By the time Rutherford left Canada for Manchester in 1907 the general nature of radioactivity had been made clear, the disintegration theory was well established, and the long series of changes in uranium, thorium and actinium were well understood. It had been shown almost certainly that lead was the final product of disintegration (an assumption which, said Rutherford in 1905, will make even the metaphysicians dizzy), and over twenty new radioactive elements of short life had been discovered. Some chemists were busy trying to fit them in to the periodic table; with considerable ingenuity places were found for some sixteen of them, but the rest had to be regarded as pseudo elements. Within two more years it was established that uranium-X and thorium were chemically indistinguishable, that radium-D could not be separated from lead, and that there were many other cases which indicated that elements of different atomic weights could have identical chemical properties. The observations led finally to Soddy's theory of isotopes and to the displacement law, which showed definitely that the properties of the elements were not primarily determined by atomic weights, but that some broader generalisation was necessary.

The happiest part of Rutherford's life was spent at Manchester, if one can say that of a life that was always happy. Rutherford found a well equipped laboratory, a prince of research assistants in Geiger, and he soon gathered round him a team of able and enthusiastic younger workers. It was at Manchester that the most dramatic event of his scientific career happened—the discovery of the real nature of the atom. Marsden had been told to see if he could detect if alpha rays could be scattered through large angles when they were projected at thin sheets of metal. "I may tell you, in confidence," said Rutherford, "that I did not believe they would be." The unexpected happened, and two or three days later Geiger came along to say that some of the alpha particles had come backwards. "It was quite the most incredible event that has ever happened to me in my life. It was almost as incredible as if you fired a 15-inch shell at a piece of tissue paper and it came back and hit you." Rutherford went away, and by mathematical processes showed that the observation could only be accounted for if the greater part of the mass of the atom were concentrated in a volume very small compared with the apparent volume of the atom. On the assumption that this nucleus was positively charged he calculated the general laws of scattering of alpha particles which were afterwards completely verified by experiments.



The late Lord Rutherford.

The Structure of the Atom

Rutherford was fully conscious that his atom should not be stable according to the current theories of electromagnetic radiation, but he was so confident of his results that that meant there was something wrong with the theory, not with the atom. How he was justified in the event we all know. Bohr, by a theoretical investigation which Rutherford afterwards described as one of the greatest triumphs of the human mind, showed that if Planck's quantum theory, with certain assumed conditions, were applied to the Rutherford atom, the complicated relations of line spectra could be explained. His theory has been considerably modified since it was first put forward, but it quickly served to show how the Rutherford atom could account for the general properties of the different elements, and could provide an explanation of the periodic law. In more recent years it has led to a new electronic theory of valency, which has revolutionised chemistry by bringing a large number of disconnected facts into a harmonious whole and providing a new and fruitful basis for chemical research.

Revolutionary Changes in Chemistry

By 1914 Moseley's researches on the X-ray spectra of the elements had added evidence of the utmost importance in favour of Rutherford's and Bohr's theories, and had quickly led to the discovery of missing elements. The position, so far as chemistry was concerned, was that yet another revolution had been effected through Rutherford's work. Atomic weights were no longer the decisive factor in determining the chemical properties of elements; what mattered was the atomic number, or charge upon the central nucleus.

In 1914 Rutherford's work was rudely interrupted by the War, and for the next four years he was engaged on work of national importance. He got back to his own work at the end of 1918 with renewed vigour and started at once to attack the structure of the nucleus, a problem which he had said a few years back must be left to the next generation. His efforts were quickly rewarded. Within a year he proved unmistakably that nitrogen was destroyed by alpha particles and that hydrogen was a product. From that day to this there has been a continuous and almost bewildering addition to our knowledge of the structure of the nucleus and of the transmutation of the elements. The pace was quickening even at the end of Rutherford's life. Many of the results are of no direct interest to chemistry except in so far that every advance in fundamental physics is bound to affect chemistry.

So we can summarise Rutherford's influence on chemistry in the following way. By his early work on the disintegration of elements he destroyed the chemists' conception of the nature of atoms, and by doing so gave the atomic conception of matter a reality which it never had before. By his work on the scattering of alpha rays he removed the blots on the periodic system by removing its foundation and replacing it with something better. In doing so he caused the development of a new and fruitful conception of valency. By his work on transmutation of elements he opened up an immense field of experimental work for the chemist, a field which few can doubt will yield results of the utmost importance in biology as well as in chemistry.

The secret of Rutherford's success in inspiring others lies not only in his genius but in his unselfishness. Surely there never was a great man who gave so much credit to others. This was not a quality of his later years when his reputation was established, and could not possibly be affected by anyone else's reputation. It was a quality that he had from the very beginning. It was that quality which endeared Rutherford to his associates, that brought him loyalty and affection as well as admiration. He would always do anything he could to encourage others. In his last published lecture at Cambridge he said: "Scientists are not dependent on the ideas of a single man, but on the combined wisdom of thousands of men, all thinking of the same problem and each doing his little bit to add to the great structure of knowledge which is gradually being erected." There spoke the genuine Rutherford. It was for this co-operation that he worked all his life, and it was this that was not the least of his achievements.

Professor F. G. Donnan.

The Rôle of Osmotic Pressure in the Development of Chemical and Biochemical Science*

By
PROFESSOR F. G. DONNAN, C.B.E., F.R.S.

IT was a fortunate moment for the development of chemical science when De Vries turned van't Hoff's attention to the quantitative measurements of osmotic pressure which the botanist Pfeffer had already made, for van't Hoff, following up this clue, was led to the discovery of the general law relating the osmotic pressure of a dilute solution to the molecular concentration of the solute and the absolute temperature. It is not my purpose to discuss van't Hoff's famous equation, PV=iRT where P is the osmotic pressure, V the volume of the solution containing one gram mol of the solute, R the universal gas content, and T the absolute (Kelvin) temperature. Suffice it to say that in the case of dilute solutions of non-electrolytes the factor i was found to be very nearly unity, while the strikingly higher values of i in the case of dilute solutions of electrolytes in water formed one of the strongest arguments for the general validity of Arrhenius' theory of ionisation in aqueous solution.

Important Results Arising from van't Hoff's Work

Two very important practical results flowed from van't Hoff's osmotic-thermodynamic treatment of dilute solutions. In the first place, the approximate molecular weights of non-electrolytes could be securely determined from measurements of the lowering of vapour pressure (or the elevation of boiling point) and the depression of freezing point of dilute solutions, since the theory of these methods was placed on a sure basis. This result was of very great importance for organic chemistry, and, as is well known, Beckmann, by means of his delicate variable thermometer, soon brought this method into common laboratory use. Secondly, in the case of electrolytes in aqueous solution, the same technique enabled approximate values for the degree of ionisation to be determined.

I do not think that van't Hoff himself or any of his immediate collaborators made any direct measurements of osmotic pressure, since in the case of most substances of moderate molecular weight it is difficult to obtain semipermeable membranes. In subsequent years very elaborate direct measurements of the osmotic pressure of solutions were made, especially by Morse and Frazer in the United States, and by the Earl of Berkeley and his collaborators in England. These investigations were more particularly directed to the measurement of osmotic pressures in the case of relatively concentrated solutions, and required the construction of special membranes which could withstand high pressures. The results showed how, for example, in the case of cane sugar, the osmotic pressure in the case of these relatively concentrated solutions deviated from the simple PV=RT law. Writers of textbooks often refer to such results as deviations from "van't Hoff's Law," but it is to be noted that van't Hoff's law was PV=iRT. Only in the case of a volatile solute which obeyed Henry's law in the range of concentrations employed was it possible for van't Hoff to prove by thermodynamical reasoning that i=1. In the vast majority of cases such a test was not possible, so that it was a matter of experiment to determine at what degree of "dilution" the value i=1 could be employed (in the case of non-ionised substances). From many conversations which I had with van't Hoff, I know that he considered the PV=RT law to be a "limiting law," which possessed approximate applicability (in the case of a non-electrolyte) only in the case of very dilute solutions.

*Extracts from the Presidential Address to the Chemical Society on March 30.

Osmotic Pressure in Biochemistry

The theory of solutions as elaborated by van't Hoff, Arrhenius, Ostwald, and Nernst played an important part in the development of biochemistry. For an exhaustive account of this, I cannot do better than refer you to the two volumes of H. J. Hamburger's *Osmotischen Druck und Ionenlehre in den medicinischen Wissenschaften* (Bergmann, Wiesbaden, 1900-1904), and, for a later account, to R. Höber's *Physikalische Chemie der Zelle und der Gewebe*. (Engelmann, Leipzig, 1922). Although the ordinary chemist may be only indirectly interested in the subject of osmotic pressure, since, so far as his practical operations are concerned, he has seldom to do with semipermeable membranes, the physiologist and biochemist are deeply concerned with the phenomena produced by the semipermeable membranes occurring in living organism.

Modern chemical interest in the subject of osmotic pressure arises from a series of discoveries which concern substances of very high molecular weight. The first impulse came from the physiologists and biochemists, whose investigations have led them to study very closely certain important classes of naturally occurring substances such as the animal and vegetable proteins and various complex carbohydrates, e.g., cellulose, starch, etc. Another impulse has come from the industrial use of synthetic polymers, which play such an important part in the production of new materials of construction. It will not be denied, I think, that in the investigation of this new world of "megamolecules" (to borrow an expression from Dr. Wrinch) much has been learned by means of physical and physico-chemical methods, which could not have been obtained by the classical methods of "pure" organic chemistry. In this connection the method of X-ray analysis has proved of very great importance, but a great deal of new and valuable knowledge concerning the particle (or molecular) weight, volume, and shape of these "giant" molecules has been gained by a study of their behaviour in solution. In the chief position of honour we must place the ultracentrifugal method of Svedberg, but measurements of osmotic pressure, viscosity, rate of diffusion, cataphoresis, and double refraction due to streaming and to electric and magnetic fields have all played a notable part.

Osmotic Pressure Measurements for Molecular Weight Determinations

In consonance with the theme of this address, I shall confine myself to saying something about only one of these physico-chemical methods, namely, the determination of osmotic pressure. Here the direct measurement has come into its own, and has been of great value in the ascertainment of molecular (or particle) weights in solution. We may ascribe this to several practical reasons, namely (a) the impracticability of the usual freezing- and boiling-point methods; (b) the comparative facility in obtaining semipermeable

membranes for substances of very high molecular weight; (c) the smallness of the osmotic pressures in question; and (d) the simplicity and cheapness of the apparatus required.

As regards (a) the following remark may be made. Let us consider a non-ionising substance of only " moderately high " molecular weight, say, 40,000. The lowering of freezing-point for a solution containing 20 grams per litre would then be about 0.001° C., whilst the osmotic pressure, measured in cms. of water, would amount approximately to 10. An approximate calculation of this sort demonstrates very clearly the practicability of the osmometric method and the impracticability of the ordinary (Beckmann) thermometric methods.

Owing to the great extent of this comparatively new branch of chemical science, I propose to say something about a particular aspect of it, in which I have been personally interested during the last few years. This concerns the determination of the molecular weights (in solution) of the salts of multibasic acids of high molecular weight, such as are encountered, for example, in gum arabic and the salts of alginic acid. We are not able, in these cases, to reduce the free ionisation by working near the isoelectric point, as in the case of proteins. Hence we are obliged to compensate for the large osmotic effect of the free (alkali) cations by using as large a concentration as possible of a freely diffusible salt, such as NaCl. Moreover, as it is not generally possible to obtain a complete compensation by this device, it is desirable to work at such low molarities of the high molecular salt that graphical extrapolation to the zero concentration limit becomes practicable. This means that extremely delicate and sensitive osmometers have to be employed, since the osmotic pressures to be measured are very small.

In the presence of a sufficiently high relative concentration of a freely diffusible salt, such as NaCl, there occurs, at equilibrium, an unequal distribution of these diffusible ions, which has the effect of setting up a counter osmotic pressure which tends to compensate, partially or wholly, for the large osmotic pressure due to the free alkali cations of the high molecular salt. If, as frequently happens in the case of these high molecular multibasic acids, the " multibasicity " is high, then, in spite of the very high molecular weight, the equivalent weight may be comparatively low. Under these conditions it is not generally possible to employ an equivalent concentration of sodium chloride or other such salt which is sufficiently great compared with the equivalent concentration of the high molecular salt to secure the desired high compensation of the osmotic effect of the alkali " gegenions " and at the same time avoid agglomeration or actual precipitation. This difficulty can, however, be surmounted by working as near as possible to the zero concentration limit of the high molecular salt.

I conclude this discussion by quoting very briefly a few of the results of investigations in which I have been personally interested during the last four or five years. I suggested to Dr. H. B. Oakley that he should investigate the molecular (or micellar) weight of the alkali salts of the acid of gum arabic by means of the osmometric method. Here is one result taken from his work: Molecular weight 240,000, maximum electrovalency (basicity) 200, equivalent weight 1,200.

Another example of a high molecular multibasic acid is the alginic acid discovered in certain seaweeds by Stanford in 1883. At my request, Dr. R. C. Rose has made a very beautiful and comprehensive study of the sodium alginates. As this work is not yet published I must restrict myself to stating that Rose, employing the osmometric method, has found, in the case of aqueous solutions of the sodium salt of different grades of alginic acid, particle (or molecular) weights varying from about 50,000 to 180,000. I may remark that both the gum arabic acid and alginic acid are carboxylic derivatives of complex carbohydrates. It is interesting to note that gum arab (or gum acacia) was one of the substances classed as a true colloid by Thomas Graham in 1862. It would, no doubt, have greatly interested him to know that some seventy-two years later the molecular weight would be determined at University College, London.

The Chemical Society

Anniversary Dinner—Lord Samuel on Science's Benefits

THE anniversary dinner of the Chemical Society was held at Grosvenor House, London, on March 30, with the President, Professor F. G. Donnan, in the chair and a company of about 260 members and guests present.

Proposing the toast of " The Chemical Society," LORD SAMUEL said that the Society was not only one of the largest, but it was the oldest chemical society in the world. We might have lost the lead in some branches of science but that would be changed; we were at least free to develop science in the way we liked. He pointed out that industrial success was largely due to the scientist and to-day, when there must be vast economic resources which could only be achieved by the success of industry and commerce, chemists were performing an economic and patriotic service. It was the function of the State to develop science, but hitherto science had taken too small a place in the view of the public. In the modern world it should occupy the very central position. We lived in times of peril and anxiety, he added. The misuse of scientific discoveries for the purposes of war and destruction, however, was infinitely outweighed by the immeasurable benefits science had conferred on the modern world. It was not for science to give the ultimate direction of human activities; that was for religion and the philosophies.

PROFESSOR F. G. DONNAN, the President, responding to the toast, said that the Society was increasing both in membership and activity and that he had great hopes of closer co-operation with the other chemical societies. He added that the last two years, during which he had acted as president, had been a most delightful experience and he thanked all the officers of the Society for the tremendous amount of work they had done and the most helpful way in which they had supported him.

In proposing the toast of " The Guests," SIR ROBERT ROBINSON, President-elect, made particular reference to Sir William Bragg, Sir Albert Seward, Dr. C. G. Darwin, Sir Robert Pickard, Sir Henry Tizard, Dr. Irvine Masson, Lord McGowan, Lord Leverhulme, and Professor I. M. Heilbron. SIR ALBERT SEWARD, President of the British Association, and DR. C. G. DARWIN, Director of the National Physical Laboratory, responded. The last toast of the evening was " Kindred Societies," which was proposed by DR. H. J. T. ELLINGHAM, and to which MR. W. A. S. CALDER, President of the Institute of Chemistry, replied.

Finally, Sir Robert Robinson was inducted as President by the retiring President, Professor F. G. Donnan.

Among those present were: Professor H. V. A. Briscoe, Mr. T. F. Burton (Editor and Secretary, Bureau of Chemical and Physiological Abstracts), Dr. F. H. Carr, Mr. S. E. Carr (General Secretary), Professor G. R. Clemo, Mr. F. W. Clifford (Librarian), Dr. W. H. Coates, Professor J. W. Cook (Honorary Secretary), Dr. C. W. Davies (Honorary Secretary), Professor C. H. Desch, Mr. F. P. Dunn (Treasurer), Dr. Bernard Dyer, Professor A. C. G. Egerton, Mr. E. V. Evans, Dr. J. Vargas Eyre, Professor A. Ferguson, Dr. J. J. Fox, Professor W. E. Garner, Professor C. S. Gibson, Professor J. M. Gulland, Sir Arthur Harden, Sir Harold Hartley, Wing-Commander W. Helmore, Dr. T. A. Henry, Professor A. V. Hill, Mr. Charles A. Hill, Dr. L. A. Jordan, Dr. B. A. Keen, Dr. J. Kenyon, Mr. James Kewley, Mr. Alexander King, Dr. C. B. Kingston, Dr. H. Levinstein, Sir Edward Mellanby, Dr. A. D. Mitchell (Assistant Editor), Dr. G. T. Moody, Professor T. J. Nolan, Professor F. A. Paneth, Dr. C. C. Paterson, Professor R. A. Peters, Professor J. C. Philip (Vice-President), Col. J. H. Porter, Mr. Wilfrid Price, Professor E. K. Rideal (Vice-President), Mr. A. T. Roach, Professor W. H. Roberts, Sir Robert Robertson, Professor R. Robison, Mr. F. Heron Rogers, Dr. G. Senter, Professor J. L. Simonsen, Dr. R. E. Slade, Dr. Clarence Smith (Editor), Professor S. Sugden (Vice-President), Mr. S. K. Thornley, Professor J. F. Thorpe (Past-President), Dr. M. A. Whiteley, and Mr. W. J. U. Woolcock.

Applications of Physics to Industry

The Annual Report of the National Physical Laboratory

A REVIEW of the more important researches and investigations which have been completed during 1938, or which have reached a definite stage in their progress during that period, is contained in the report of the National Physical Laboratory for 1938.

In the Physics Department the past year has again been one of activity in a variety of directions. On the subject of heat, particular attention has been given to problems of thermal conductivity. Work on the Lorenz functions of a large number of metals and alloys has been brought to a conclusion, the results showing that, except at high temperatures, it is not possible in general to infer the thermal conductivity with accuracy from a knowledge of the electrical conductivity. A group of high-temperature investigations on certain thermal properties of steel, for the Alloy Steels Research Committee, is yielding a collection of interesting thermal constants in a field of research which has remained largely unexplored.

The work for a Joint Committee of the Iron and Steel Institute and the British Iron and Steel Federation, on the temperature measurement of liquid steel in the various stages of works conditions, is well-nigh completed, and may, it appears, be regarded as having provided an acceptable answer to a problem of long standing that was looked upon in some quarters as almost impossible of solution. Measurements of the latent heats of fusion of certain refrigerants have been completed on behalf of the Food Investigation Board. In the Radiology Division a group of investigations have dealt with the applications of X-ray crystal analysis to a variety of industrial problems.

A Study of the Thermal Constants of Steels

The Alloy Steels Research Committee has arranged with the Laboratory for the study of the thermal constants of a considerable number of carbon and alloy steels, in particular, the specific heat, heat of transformation, thermal expansion and the thermal and electrical conductivities. So far, it would appear that, in general, the purer the iron the higher the thermal conductivity, alloying usually leading to a reduction in the value. For temperatures up to about 300° C. the temperature coefficient is negative for steels of high conductivity, zero for those of medium value, and positive for those of low conductivity.

As regards the specific heat and heat of transformation, measurements have been completed up to 900° C. for a group of eight carbon steels, with carbon contents ranging from a low value (0.06 per cent.), through the eutectoid composition of 0.85 per cent., up to 1.2 per cent. These steels have specific heats which steadily progress from about 0.116 at 50° C. to 0.18 at 580° C., there being no indication of the sudden irregularities which have been claimed by some workers. At higher temperatures, the specific heats of the steels of higher carbon content increase markedly over a band of about 50° in the magnetic transformation region. The carbon steels possess in general a fairly regular thermal expansion up to about 700° C. This is followed by a shrinkage amounting to about 0.1 per cent. over a band of about 100° in the magnetic transformation region. The steels then resume their regular expansion, though at a greater rate than before, up to 1,000° C.

Conductivities and their Measurement

Measurements of thermal and electrical conductivity are also being carried out on a number of other metals and their alloys, *e.g.*, magnesium and aluminium, as well as on typical amorphous carbon, and graphite.

For thermal conductivity measurements at high temperatures (above 800° C.), longitudinal heat-flow methods on rods have not the practical advantages of radial-flow methods, in which a rod or tube of the material under test is electrically heated to a steady temperature in an evacuated enclosure, the thermal conductivity being derived from the energy dissipated in the centre section of the specimen and the radial temperature gradient. The method has been applied to the determination of the thermal and electrical conductivities of several varieties of carbon. At normal temperatures the Lorenz functions of typical amorphous carbon and graphite are respectively some 17 and 200 times greater than the "normal" electronic value. For both materials, the Lorenz function decreases rapidly with increase in temperature, reaching a common value at 1,700° C., which is about four times the normal figure, and shrinking further to only twice this value in the case of graphite at 2,500° C.

A radial heat-flow method has also been used to extend to 1,000° C. some earlier measurement on Armco iron. The thermal conductivity is found to decrease steadily as the temperature is raised to the magnetic transformation region, where it reaches a minimum.

An Investigation of the Oxidation of Zinc

In co-operation with the Chemical Research Laboratory, an investigation of the atmospheric oxidation of zinc is being undertaken. In this work both X-ray and electron diffraction methods have been used. The results, so far, show that there is a considerable difference in the nature of the oxide film, according to whether it is produced at low or at high temperatures. For temperatures below about 200° C. there is a tendency for the greater part of the oxide to be amorphous, whereas at higher temperatures a crystalline oxide is formed immediately. Detailed studies have been made of the early stages of oxidation at various temperatures, and it has been shown that the layers first formed showed a marked preferential orientation, and that this is more pronounced when the underlying zinc metal contains large crystals produced by suitable annealing. The electron diffraction results have been of assistance in interpreting the weight-increment/time curves obtained in the course of the work carried out in the Chemical Research Laboratory.

Dielectric Properties of Plastics

In the Electricity Department an investigation is being carried out into the fundamental dielectric properties of insulating materials, especially those properties which are associated with the dissipation of power in the materials under the action of alternating voltages. Recent developments in insulation practice are to a large extent bound up with progress in the plastics industry and the increasing use of synthetic resins. Accordingly, the work carried out in the last few years has consisted of a detailed examination of some typical plastics over a wide range of experimental conditions. In the first instance commercial materials were used. The results of a part of the investigation, consisting of a study of the power losses in cellulose acetate in sheet form obtained from various commercial sources, have recently been published. (*J. Inst. Elect. Engrs.*, 1938, *83*, 315). The results suggested that the power losses in the material are largely of the nature of dielectric absorption, which arises partly from ionic conduction in certain restricted paths, such as surfaces of discontinuity within the material, and partly from movements of the molecules arising from their polar character.

On extending the investigation to other plastics it became desirable to work with pure materials of known chemical composition; as well as commercial materials, and the co-operation of the Chemical Research Laboratory was secured. A series of pure resins of the phenolic type was specially prepared for the investigation and the dielectric properties of these materials in the form of thin films were studied in detail. The results

give an indication of the relation between these properties and the physical and chemical structure of the material.

During 1938 the Institution of Electrical Engineers and the Plastics Group of the Society of Chemical Industry held a joint meeting for the discussion of problems bearing on plastics for electrical insulation, and an account of this investigation, together with a general survey of the whole field, was presented to the meeting as a basis for the discussion (*ibid*, 474). It is shown that the property of plasticity arises when the molecules of a material are complex structures built up from simple units, and existing materials were classified according to the chemical character of their structural units. The electrical properties appear to be characteristic of the units rather than of the structure as a whole, and therefore it is possible from the data already obtained to form some idea as to the direction in which the ideal insulating material is to be sought.

Testing Volumetric Glassware

The quantity of volumetric glassware tested in the Metrology Department during 1938 was slightly greater than in the preceding year. The quantity tested annually has been increasing steadily throughout the past few years and is now approximately double that tested in 1933. A revised schedule of fees for the tests on volumetric glassware has been brought into operation, covering a considerably larger range of apparatus than the old schedule.

The Laboratory has continued its collaboration with the British Standards Institution in the preparation of specifications of volumetric glassware. Assistance has been given with the specifications for Ostwald-Folin pipettes and one-mark capillary pipettes issued during 1938, and work is in progress on specifications for burettes and bulb burettes, haemoglobinometers and ordinary bulb pipettes, and on the revision of the specifications for apparatus for the determination of water by distillation with an immiscible liquid.

The number of hydrometers received for test has remained about the same as in previous years. Density hydrometers for use in milk are now regularly received for test for conformity with the British Standard Specification No. 734, issued in 1937. The Laboratory has co-operated with the British Standards Institution in the prepartion of density-composition tables for aqueous solutions of caustic soda, sodium chloride and calcium chloride for use in conjunction with British Standard density hydrometers.

An Investigation of Welded Joints in Pressure Vessels

Considerable progress has been made in the Engineering Department with the investigation in progress for the Gas Cylinders and Containers Committee into the strength of various types of welded construction for pressure vessels, mentioned in the Report for 1937. The object of this work is to obtain detailed experimental knowledge of the properties of fusion welds (electric arc and oxy-acetylene), in comparison with good water-gas forge-welds, when used for the longitudinal joints in large pressure vessels for the transport of liquefied gases such as ammonia and chlorine. As a result of co-operation between Lloyd's Register of Shipping, steel manufacturers, the British Standards Institution, and, in particular, some of the largest welding firms in the country, representative welds in steel plates $1\frac{1}{4}$ in. thick, $\frac{3}{4}$ in. thick, and $\frac{1}{4}$ in. thick, have been made available for detailed testing and examination at the Laboratory. The welds were made in plates at least 6 ft. long, under normal industrial conditions, so that they can be regarded as representative of joints which would be made in practice using modern forge welding, electric arc welding and oxy-acetylene welding. The finished joints were first subjected to careful radiographic examination, and samples were then submitted to detailed tests, such as tensile, bend, and notched bar impact (Izod) tests, chemical analysis and microscopical examination. In addition, fatigue and special single-blow impact tests have been made on the joints and plates. Accordingly, detailed information is now available of the various forms of welding in comparison with each other, and also in comparison with the unwelded plate material. It cannot be said from the results that any of the welds have been quite as good in all respects as unwelded plates, but it can certainly be said that in some cases the welded joints are very little inferior to an unwelded plate, and this applies to more than one type of weld.

In the Department of Metallurgy and Metallurgical Chemistry an account of the anomalies found in the age-hardening of alloys with 4 per cent. of copper, prepared from aluminium of exceptionally high purity, has now been published (*J. Inst. Met.* 1938, *03*, 67). It has been found that whilst the normal method of hot-forging at 450° C. before solution treatment produced no age-hardening at atmospheric temperatures, and hot-pressing at 500° C. gave a similar result, cold-working produced a condition in which the alloy would respond to solution treatment. This suggested that, owing to the great softness of the pure aluminium, it flows over the rounded particles of the copper compound without crushing them, whilst during hot-working, recrystallisation and grain growth proceed very rapidly.

An investigation of the transformations in alloys of aluminium and zinc has been carried out, using spectroscopically pure zinc and 99.99 per cent. aluminium. Thermal and microscopical evidence indicates that a peritectic reaction does not occur at 443° C., and that the observed heat change is due to a marked variation of the solid solubility of zinc at that temperature.

Forging Magnesium Alloys

The improvement of the mechanical properties of magnesium alloys by suitable forging treatment has received further attention. It is found that 200° C. is about the lowest practicable temperature for forging after the initial reduction at 400° C., and that annealing between two stages of forging is in general detrimental. The mechanical properties of alloys subjected to the double forging process have been studied, and whilst no composition has been found giving properties superior to those of the alloy with aluminium and silver which was previously described, certain alloys which are cheaper to produce and less corrodible in service have been found to approach it in strength and ductility.

The problem of steels which show an abnormally high creep rate is of considerable interest to the engineering industries, although a study of a number of industrially produced steels specially prepared for service at high temperatures shows that it is of infrequent occurrence. Instances of its existence have, however, recently been found in material which would have been eventually incorporated in high temperature plant. Work is being undertaken on more fundamental lines to study this question.

The six vacuum creep units designed for experiments over the range 350° to 950° C. have provided greater facilities for the study of the mode of deformation of pure iron, of a steel containing 0.4 per cent. of carbon, and of six high-carbon steels. This work, together with work already published, indicates the effect of carbon content.

A modified apparatus has been prepared for the examination of the effect of steam and hydrogen on the deformation of both molybdenum and plain carbon steels. This will replace one of the vacuum creep units.

The work has shown that certain molybdenum-bearing steels are suitable for resistance to the prolonged application of load at 550° C. The influence of molybdenum is greatly modified by the addition of small proportions of further alloying elements, and some elements, particularly vanadium, have a marked strengthening effect. The properties of many of these steels are largely determined by their carbide condition. Permanence of properties at the service temperatures is receiving considerable attention, particularly in regard to rate of creep and ductility as indicated by both tensile and Izod impact tests.

Among light alloys, the intercrystalline failure of the aluminium alloy containing 3 per cent. of copper and 20 per cent. of zinc has been specially studied. In the quenched (homogeneous) condition it is highly susceptible, and is not

rendered less so by a heat-treatment which allows precipitation of the copper constituent. When exposed under tension, the time to failure increases as the stress diminishes, but in salt solution cracking occurs even in the absence of external stress. Failure in air and in a salt spray appear to be similar, differing only in the rate of attack, and in some experiments conducted in the absence of air cracking under stress did not occur, whilst on re-admitting air failure took place in the usual way. Tests of Y-alloy and of 4 per cent. copper-aluminium alloy in salt spray showed the great influence of the rate of cooling on the susceptibility, quenching in cold water giving the greatest resistance to attack, either with or without an applied stress.

Another case in which intercrystalline failure is being studied is that of the so-called "caustic embrittlement" in boiler plates. Although exposure of iron and steel to prolonged stress while immersed in hot sodium hydroxide solutions had in laboratory experiments failed to produce the type of intercrystalline cracking found in service, later experimental work has shown that iron and steel specimens exposed to sodium hydroxide solution in small pressure cylinders frequently developed a form of intercrystalline breakdown resembling that observed in boiler plates which had failed in service. The results obtained with these small cylinders were extremely promising, but somewhat erratic, and consequently a further study has been made of the reaction between iron and sodium hydroxide solution in a silver-lined steel tube fitted with water-cooled seals and heated electrically. By means of this apparatus intercrystalline cracking has been freely and rapidly induced in steels of different compositions. The experiments have suggested a definite mechanism for the intercrystalline breakdown of actual boiler plates, and it is hoped to confirm this theory shortly.

A report on the examination of a number of oxygen and coal gas cylinders varying in age between 10 and 40 years has been presented to the Gas Cylinders and Containers Committee. Corrosion of the inside surface of the coal gas cylinders, accompanied by longitudinal fissures, had occurred, but was absent from the oxygen cylinders. This difference was not reflected in the behaviour of the cylinders in bursting tests. All the cylinders, irrespective of the gas they had contained, showed some deterioration in the bursting tests.

During the year a considerable amount of work has been carried out with the object of effecting improvement in large alloy-steel gas cylinders.

In pursuance of the programme of work on the accurate estimation of oxygen, nitrogen and hydrogen in steel, the efficiency of the vacuum fusion method has been tested by means of steel capsules containing known weights of various oxides and silicates. The results show that, at the high temperature employed, all of these are quantitatively reduced. The method has also been used with success to determine the oxygen content of films on the surface of steel sheet. Work on the iodine method has been mainly devoted to the examination of three steels containing varying proportions of sulphur and phosphorus. A sample of pure iron has been used for comparison, with the object of determining whether a blank must be allowed. A report on both methods will be included in the next Report of the Oxygen Sub-Committee of the Iron and Steel Institute.

HYDROGENATED OILS IN OINTMENTS

The Hungarian firm of Neovasol Vegyipari has patented the production of ointments using a base of hydrogenated animal or vegetable oils (F. P. 828,845); the oils are said to be more easily absorbed by the skin than mineral oils. The oils are hydrogenated to increase their viscosity and in some cases the hydrogenated product cannot absorb more than 2 per cent. of water. This is particularly advantageous where it is desired to use the base for anhydrous ointments. Possible oils are gourd seed oil, castor oil, sunflower seed oil, cod liver oil and soya bean oil. When hydrogenated, they can be absorbed through the skin very easily and form excellent media for a wide range of products.

Concentration of Sulphur Dioxide and Reduction to Sulphur

British, Swedish, German and Swiss Patents Pooled

IT has been agreed, as announced briefly in our issue of last week (page 243), that certain patents and processes, related to sulphur recovery, owned by Imperial Chemical Industries, Bolidens of Sweden, the Chemische Industrie of Basle, and Lurgi Chemie of Germany, shall be pooled. The following are the main events leading up to this development.

In 1934 Imperial Chemical Industries, Ltd., patented a process for the production of 100 per cent. SO_2 from weak SO_2 gas by the use of a solution of basic aluminium sulphate. A plant with a capacity of 50 tons per day of liquid SO_2 was built in Finland and has been in commercial operation since 1936. A similar plant, with a capacity of 5 tons per day, is working near Manchester. I.C.I. also worked out and patented a process for the reduction of concentrated SO_2 to sulphur, by means of coke.

Prior to this Bolidens Gruvaktiebolag had developed a process for the direct reduction of weak SO_2 from smelter gases and this process has been operated for several years at their mine in Sweden, with a production up to 70 tons of sulphur per day.

In view of the complementary nature of these processes an agreement was formed in 1936 whereby the patents and processes of the two companies were pooled and a company formed as Sulphur Patents, Ltd., to act as sole agent to negotiate licences for processes owned by the two companies. The Chemische Industrie, Basle (Ciba) had, about the same time, devised a process for concentrating SO_2 in which the absorbing medium was an emulsion of aromatic-amino in water.

Agreement between Competitive Groups

An agreement was come to with the Metallgesellschaft of Frankfurt under which this process was developed on a manufacturing scale and Lurgi Chemie (a wholly owned subsidiary of Metallgesellschaft) has built a plant in Germany with a capacity of 5 tons per day of SO_2 and one in France with a capacity of 30 tons. Lurgi Chemie also worked out a process for the reduction of such concentrated SO_2 to sulphur. Hitherto the two groups (I.C.I./Boliden and Lurgi/Ciba) have worked in competition in the field of the concentration of SO_2 and its reduction to sulphur.

It has now been agreed that the patents and processes, in this field, owned by all four companies shall be pooled. This will enable the best process or combination of processes to be applied to each particular problem. In view of the fact that Lurgi Chemie is a company whose specific object is the design and construction of chemical plants, it has been agreed, by the members of the pool, that the exploitation of the processes shall be placed in the hands of Lurgi Chemie. Inquiries in connection with the processes should therefore be sent to: Lurgi Gesellschaft fur Chemie und Huttenwesen m.b.h., Lurgihaus, Gervinusstr. 17/19, Frankfurt A.M., Germany.

Chemical Matters in Parliament

Northern Ireland Sugar Beet Subsidy

In the House of Commons last week Colonel T. Sinclair (for Viscount Castlereagh) asked the Chancellor of the Exchequer what amount, directly or indirectly, Northern Ireland had contributed to the sugar-beet subsidy during the last 15 years; and what amount of that subsidy had Northern Ireland farmers received.

Sir J. Simon replied that Northern Ireland had not contributed directly to the sugar-beet subsidy during the period in question; Northern Ireland farmers did not grow sugar-beet and had received no part of the subsidy. He knew of no satisfactory basis for estimating what amount, if any, Northern Ireland could properly be said to have contributed indirectly to the subsidy.

Lord McGowan on Labour Policy

Frank Discussions of Great Value to Both Management and Workers

THE relations between labour and capital and in particular the labour policy adopted by his own company formed the main theme of a speech made by Lord McGowan, chairman of Imperial Chemical Industries, Ltd., at a luncheon given by I.C.I. Metals, Ltd., to local industrialists in Swansea on Tuesday.

Lord McGowan said that he had that morning paid a visit of inspection to the new I.C.I. factory at Landore. This development was, he said, more than the building of a new factory—it was the foundation of a new industry, giving Swansea for the first time an interest in a purely engineering concern. Already 450 men were employed in the factory, but by the end of the year it was hoped to extend the pay roll to over 1,000. He paid a high tribute to those in charge of the operations who, starting in December, 1937, had carried out the work so expeditiously that the factory went into production on January 2, 1939. The works covered an area of 7½ acres and no fewer than 40,000 tons of earth had had to be removed. I.C.I. had been happy to make this contribution to the unemployment problem and one of the outstanding features of I.C.I. activities in South Wales was the excellent relations with labour.

Lord McGowan, K.B.E., D.C.L., Ll.D.

Those concerned with policies of large companies stood in a position of unique responsibility. They had to weigh carefully the apparently conflicting claims of shareholders, personnel and customers. Although these were not conflicting claims it was hard to convince people of this since self-interest was still unfortunately the dominant motive in human affairs. A real solution could only be provided if self-interest were subordinated to service as the main-spring of all activities.

Features of the I.C.I. Labour Policy

Lord McGowan went on to explain that his Board had deliberately adopted a labour policy in the same way that they had adopted commercial, technical and research policies. They did not imagine that co-operation of employees would "fall like manna from Heaven" without any effort on their part. A permanent department had been established to advise the Board on industrial matters and works councils had been formed, composed of equal numbers of workers and management representatives. This had facilitated the frank discussion of mutual difficulties and had proved of great value to both management and workers. The works councils, however, had never been intended to minimise the importance of the trade unions and Lord McGowan paid a special tribute to the able manner in which the trade unions concerned with I.C.I. employees in the Swansea district had assisted the company in any difficulties which had arisen. The most far-reaching schemes evolved were those for providing pensions and some years ago it was decided to give workers one week's pay with their holidays. It would be appreciated that I.C.I. was making a real effort to do all it could for its people and to fulfil its obligations to workers, shareholders and customers alike. Other features of the I.C.I. labour policy were the grading system, conferring on selected workers a greater degree of security and an improved status; the monthly magazine providing valuable contact between management and personnel; compensation of workers displaced through reorganisation or improvement in manufacturing processes; rewards for long service and bravery, the Savings Bank Scheme, etc.

The price level of I.C.I. products was of vital importance since the company supplied most industries in the country and its prices were, therefore, of national significance. The bulk of manufacture was supplied to concerns for incorporation in finished articles. Due attention must therefore be paid to the competitive position of such concerns, particularly with regard to international trade, otherwise their business would be diminished to the detriment of I.C.I. workers. In conclusion Lord McGowan pointed out that we all live on each other's prosperity. "Sooner or later, we all move together, whether upwards or downwards. It is our task to see that we share on a fair and equitable basis in this general movement."

LORD McGOWAN RECEIVES FREEDOM OF SWANSEA

Later the same day Lord McGowan received the freedom of the Borough of Swansea. Acknowledging the honour he declared that during the last ten years, a cloud of depression had spread over the industrial life of South Wales. Many countries were now competing for the world's demand for coal and it was doubtful whether South Wales' old prosperity based on coal could be recovered. Industrial corporations endeavoured to arrange quotas with their opposite numbers in other countries to prevent a scramble for trade involving insensate competition, lower profits and prejudice to the workers. Lord McGowan added that he saw no reason why that principle should not be applied to the coal industry, and he sometimes wondered if the Foreign Office, in making political treaties with foreign countries, were sufficiently alive to the necessity for safeguarding our balance of trade. He added a word of warning. Experience of commercial and industrial life had led him to the opinion that however distressed an area might be, it was fallacious to think it wise to establish industries in those areas without due regard to their economics. Successive governments had given much thought to this problem, and although not much progress had yet been made in creating industries in distressed areas, we must not despair. We were going through trying times, but whatever our politics, we were all under a debt to Mr. Chamberlain for carrying us through the September crisis. Lord McGowan expressed his fear that what had happened during the past few weeks had set the clock back again and might have arrested the spread of confidence. I.C.I. was, to a large extent, a barometer of trade in this country, and growing confidence in the earlier part of the year had been reflected in an increased demand for their products. It was difficult to say whether that confidence would be maintained, but if war did not break out, he believed that the present year would show a return to prosperity. This was not a time for any show of weakness on the part of our industrial leaders. Rather the contrary, for when he was in Germany last year he had noticed the progress made in many industries in that country and we would have to see that we were not beaten in our supremacy in industry—the life blood of the country.

"Wherever possible," added Lord McGowan, "I preach

the necessity of spending money on research in our industrial life. It is the only way of improving the efficiency of our processes on which depends our competitive power with the rest of the world; the only way to find new products with which to tempt new buyers. Manufacturers will have to concentrate on producing goods more cheaply so that they can bring them within the range of more people."

He concluded by saying that there was no occasion for despair. We had come through crises before and would come through again. The world was looking to Great Britain for a lead and he knew that Swansea would be ready and eager to play its part in the great problems facing civilisation at the present time.

Synthetic Oils from Coal

The Fischer-Tropsch Process

The following is a summary of a lecture on "Synthetic Oils from Coal" given to the Manchester Literary and Philosophical Society on March 24 by Dr. W. A. Macfarlane.

SYNTHETIC oil is made from coal on a large scale in Germany by the Fischer-Tropsch process. There has been no comparable development in Great Britain, although the first unit of an industrial plant has recently been erected in Scotland by Synthetic Oils, Ltd. An experimental plant has been operated for the past two years at the Fuel Research Station, and the lecturer was formerly in charge of the work carried out there.

Basic Features of the Process

Unlike the conversion of coal into oil by hydrogenation, as carried out at Billingham by Imperial Chemical Industries, the first stage in the production of synthetic oil is to convert coal into a mixture of hydrogen and carbon monoxide gases by treating it successively in coke ovens and water-gas generators. The gas is then built up into oil by treating it with a catalyst at a low temperature. While the hydrogenation process is worked at pressures of 3,000 lb. per square inch or more, the synthetic oil process is carried out at ordinary pressure, although medium pressures can also be used.

The crude oil product is a mixture of hydrocarbons of paraffinic type, ranging from the most volatile to solid waxes of high melting point. The petrol fraction of this crude oil is of low quality, and if the maximum yield of petrol suitable for use in modern engines is required, it is necessary to treat the major part of the crude in a cracking-plant. However, the higher boiling fractions of the crude include an excellent Diesel oil which may be used directly or blended with lower grade oils such as creosote. Lubricating oil does not occur in the crude product itself, but may be obtained by further treatment of certain fractions. The quality of this lubricating oil is superior to any that has yet been prepared by any other means from bituminous coal. The most recent development in Germany is the preparation of soap by oxidation of other fractions of the crude oil.

Work at the Fuel Research Station

The lecturer described the work which has been carried out on this process at the Fuel Research Station. Its primary object has been to ascertain the quality of lubricating oil that can be obtained. For this purpose, a plant treating approximately 100 cu. ft. an hour of gas for synthesis has been developed and operated for long periods. In addition, experiments have been made to improve the method of converting coal into gas of the right composition for synthesis. Research carried out by a member of the Fuel Research Station staff, under the direction of Professor Rideal at Cambridge, has thrown new light on the nature of the chemical reactions involved, and it is to be expected that this information will have important practical application in the future.

National Service

Amendments to Reserved Occupations Schedule

CERTAIN amendments involving the addition of about 30,000 workers to the Schedule of Reserved Occupations were made last week after consideration of suggestions received from employers' and workers' organisations.

It is emphasised that it is not to be supposed that the amendments mean an end to the adjustment of the schedule, which continues to receive careful review, and it is emphasised also that those in reserved occupations are not debarred from any part-time National Service, particularly in the A.R.P. services.

The first set of amendments include a list of occupations which appeared in the Provisional Schedule of Reserved Occupations and from which men of any age may now be recruited for pilots and other members of aircraft crews. Employees so affected include workers in productive processes, other than labourers, in the following industries: Pig iron manufacture (blast furnace), wrought iron manufacture (puddling furnace), steel manufacture, iron and steel rolling (excluding sheets), tinplate mill (worker and sheet mill worker), iron and steel tube manufacture, aluminium manufacture, copper manufacture, lead manufacture (leaden goods maker), zinc manufacture, brass, bronze and other alloy manufacture, other non-ferrous metal manufacture, non-ferrous rolling (including sheets), non-ferrous tube manufacture (including all extrusion processes), metal manufacture, rolling and tube drawing (miscellaneous workers), and metal manufacture (including rolling and tube drawing).

Additions to the Schedule of Reserved Occupations include the following workers (over the age of 25) engaged in gas manufacture (other than coal gas): foreman, charge hand; cylinder inspector; gas maker; compressor hand; cylinder filler.

Foreign Chemical Notes

Norway

THE ALGEA PRODUCTS COMPANY OF OSLO is planning the erection of a factory for production of seaweed meal.

Sweden

WOOD-IMPREGNATING AGENTS are being prepared from arsenic salts by the Bolidens Gruv A.B. and are in steadily increasing demand. It is understood that they are being used by eleven of the largest wood-impregnating factories.

France

MODERNISATION PLANS FOR THE ALSATIAN POTASH MINES to be carried out this year will result in a nearly 50 per cent. increase in the present daily output of 10,000 tons crude salts.

THE FRENCH DECREE OF JULY 10, 1937, stipulating wood charcoal as the fuel in 10 per cent. of privately owned lorries after June 1, 1939, has been put into successful operation and is expected to have quite a considerable influence upon the national economy. It will necessitate the creation of an industry employing nearly 20,000 workers and producing annually 500,000 tons of wood charcoal. As the process of carbonisation in use allows of recovery of the by-products, the chemical market will be faced with a considerably increased supply of acetic acid and other products. It has recently been calculated that the process will yield from one ton of wood: 50 lb. acetic acid, 30 lb. methyl alcohol and 250 lb. tar, in addition to nearly 500 lb. charcoal.

A NEW iodine recovery process owned by the Dow Chemical Co. has been patented recently (U.S. Patent 2,144,119). The iodine liberated from brine and removed therefrom by adsorption upon activated carbon or charcoal, is precipitated on the anode of an electrolytic cell employing the compressed iodine-charged carbon as cathode.

New Technical Books

A Course in General Chemistry. Revised edition. By William C. Bray and Wendell M. Latimer. Pp. 159. New York: Macmillan and Co. London: Macmillan and Co. 7s. 6d.

In this revision the authors have sought to attain more nearly their ideals of a course in general chemistry. Encouraging results were obtained at California University in an attempt to build up, step by step through a series of logically connected laboratory experiments, an understanding of the fundamental concepts of chemistry. Realising, however, that the experiments used in that attempt constituted only one of many series which might have been chosen to lead to the same end, the authors have inserted additional experiments in order that the method of approach may be varied.

An Introduction to Industrial Rheology. By G. W. Scott Blair. Pp. 143. London: J. and A. Churchill. 7s. 6d.

The science of the flow and deformation of matter has only recently been named, but the designation of rheology, which originated in America, is now generally accepted and has been translated, with suitable modifications, into a considerable number of European languages. A knowledge of at least the rudiments of this science is essential in many industries at the present time. Flow properties of many materials are important, and all over the world, industrial chemists are struggling with rheological methods, which are more truly concerned with physics than chemistry. In the author's opinion, in Great Britain, at any rate, there is so little co-ordination in the scientific work in different industries, and so few people have time to specialise, that much energy is wasted because the scientific knowledge already gained is not easily available. The aim of this book has been to bring together such knowledge for practical purposes, and it contains no more theoretical physics than is essential for the practical man. Actually, the book is a collection of lectures delivered by the author as part of his course of lectures on colloids at the Sir John Cass Technical Institute last spring.

The Electrochemistry of Gases and Other Dielectrics. By G. Clockler and S. C. Lind. Pp. 469. New York: John Wiley and Sons. London: Chapman and Hall, Ltd. 30s.

The writing of this book was undertaken at the request of the Committee of Electrical Insulation of the National Research Council, with the object of bringing together material that might be expected to throw additional light on the deterioration of liquid dielectrics. The authors, however, have treated of the entire field of dielectrics, since there is no sharp dividing line between the behaviour of liquids and gases under electrical discharge. The particular field of research which has been covered has not previously been summarised in monograph form, and the present volume should therefore fill a gap in the literature of the general topic of activation of chemical reactions by various agents. In Part I topical reactions in various forms of electrical discharge have been discussed, the reactions being illustrated by certain researches as examples. Part II deals with chemical reactions in electrical discharges, and here the authors have attempted to give a brief account of most of the reactions that have been studied, although they have not dealt in any detail with such special topics as the production of ozone and the fixation of nitrogen because these have already received attention in special treaties. Under physical and theoretical aspects of discharge reactions in Part III they have included certain topics of physics which they believe must be considered if the chemistry of discharge reactions is to be properly understood. Throughout the text the "ion cluster" theory has been used whenever it has been necessary to illustrate and discuss a given reaction.

Elementary Thermodynamics. By V. M. Faires. Pp. 225. London. Macmillan and Co., Ltd. 12s.

This book presents textual material for short courses in thermodynamics. It differs from a more complete text on the subject only in that it presents fewer topics for consideration, not in that it presents shortened discussions. Care has been exercised to use technical words in their precise meaning, although the word "heat" alone is not used in the restricted sense of "transferred heat," unless the context makes it obvious that "transferred heat" is meant. Among the subjects with which the thirteen chapters deal are the general energy equation, characteristic equations of a perfect gas, liquids and vapours, compression and expansion of air and cycles for internal combustion engines.

Systematic Qualitative Organic Analysis. By H. Middleton. Pp. 279. London: Edward Arnold and Co. 8s. 6d.

This book is intended mainly for the training of students in the general methods employed in the identification of organic compounds. During its preparation the author personally examined over 600 purely organic substances and a large number of their metallic derivatives. Conditions, necessary for a definite result, were found for every test, and then systematic schemes of analysis were built up. By following out the schemes and the instructions for a preparation of the derivatives students obtain decisive results, and thus gain confidence in their work.

The time factor has always been kept in mind, the minimum times for the various treatments having been found. The times required for the hydrolysis, under the special conditions, of about 100 esters are given. Thus if an ester is required to be hydrolysed in an examination, or during a brief practical period, one which is suitable may be chosen from the lists. For students taking lecture courses, but not requiring analytical work, the book provides rapid exercises in the processes employed in practical organic work, a special index of such exercises, not involving analysis, being included.

An Introduction to the Chemistry of Cellulose. By J. T. Marsh and F. C. Wood. With a foreword by Sir Kenneth Lee. Pp. 431. London: Chapman and Hall, Ltd. 21s.

It is the hope of the joint authors that this book will make its appeal to the "ordinary" chemist, and for this reason they have maintained a balance between the descriptions of the purely scientific aspect of the subject and the practical applications. They point out that the subject of cellulose chemistry is not among the simplest of studies, but important advances made in recent years have clarified it to such an extent that the time has now come for publication of a relatively simple book to act as a guide to the younger chemists who are entering the branches of industry concerned with applications of cellulose. As Sir Kenneth Lee emphasises in his foreword, the young research worker finds an overwhelming mass of literature before him, and those concerned with production and process control have no time for wide reading. To both, the present account of cellulose chemistry should therefore be a valuable introduction. After dealing with the occurrence and general properties of cellulose, the authors proceed to discuss dispersed cellulose and modified cellulose, followed by nine chapters (out of twenty-one) relating to the derivatives of cellulose. The final section of the book treats of constitution and structure. There is no bibliography, as sources are mentioned as the occasion arises, but there is a useful index to the patent specifications which receive notice.

Production of glue from sulphite lye by a Swedish process has been started at the Mackmyra factory of the Leim A.B. Grania (Sweden) the product being marketed as sulphite glue.

RECENT TRADE LITERATURE

THE DRAYTON REGULATOR AND INSTRUMENT CO., LTD., have issued a folder dealing with their temperature and pressure instruments. Illustrations and details are given of dial thermometers, temperature and pressure recording instruments and low-pressure and vacuum indicating instruments.

The new HF belt joining vulcaniser is the subject of a specification leaflet issued by the manufacturers of the appliance, HARVEY, FROST AND CO., LTD. The appliance is one of a complete range introduced by the company for joining transmission belts and joining and repairing conveyor belts by a radical method.

A booklet issued by SUTCLIFFE, SPEAKMAN AND CO., LTD., deals with the story of activated carbon. It contains articles on the principle of adsorption by activated carbon and on its application to solvent recovery. A description is given of the part played by recovery plants in the rubber industry, celluloid and allied industries, dry cleaning industry, artificial silk industry, oil extraction industry, alcohol production, etc. Diagrammatic and photographic illustrations of recovery plant installations are also shown.

AEREX FANS, a branch of Colliery Engineering, Ltd., have issued two brochures, Nos. 306 and 405, in connection with aerodynamic screw fans and aerodynamic screw fan plant. It is claimed for Aerex screw fans that a high efficiency of 85 per cent. to 90 per cent. is obtainable due to the aerofoil blade sections and proper aerodynamic design. Another characteristic is non-overloading, so that, though the resistance may vary in a circuit, the power absorbed by an Aerex screw fan is limited. The volume is controlled by the Aerex Aerovane control which consists of suitable inlet vanes of aerofoil section which are turned in a few degrees either with or against the direction of rotation of the rotor, thus varying the volume but maintaining the efficiency. Brochure No. 405 which deals with screw fan plant contains a number of diagrammatic illustrations of plant in operation including a steel works cold air douche plant, a dust collecting plant, a forced draught installation and a heating and ventilating plant.

THE INCANDESCENT HEAT CO., LTD., and its associate companies, the SELAS GAS AND ENGINEERING CO., LTD., CONTROLLED HEAT AND AIR, LTD., and METALECTRIC FURNACES, LTD., which together form the Incandescent Group, have issued a joint brochure describing the manufactures of each company. Emphasis is laid on the co-ordinating operations of the companies whereby frequent exchange of statistics and experimental data enables the group to serve adequately the very wide field covered by the term "industrial heat engineering." The Incandescent Heat Co. design and manufacture gaseous, liquid and solid fuel fired furnaces, both continuous and static type, the Selas Co. are designers and manufacturers of a comprehensive range of industrial heating plant, appliances and combustion equipment, Controlled Heat and Air, Ltd., specialise in all types of industrial ovens operating up to 600° C. and Metalectric Furnaces manufacture a wide range of electric furnaces.

The March number of "The Towers Messenger," published by J. W. TOWERS AND CO., LTD., contains details of a new model electric furnace, the Towers electric muffle furnace, which contains semi-automatic temperature control and pyrometer. Temperature control is effected by an energy regulator which interrupts the full load heating current for regular periods, the duration of which may be varied according to the temperature required. By this means the furnace can be maintained at any desired temperature up to 1,000° C. within at least plus or minus 10° C. A new pyrometer with edgewise type indicator is also described in the publication. It is designed for laboratory muffle furnaces, small hardening furnaces, etc., and has an overall accuracy within one per cent. of the full calibrated scale. The Victor model 50 analytical balance is another apparatus which is described. It now incorporates a number of improvements and has a capacity of 200 grms. in each pan, with a sensitivity of 0.1 milligramme.

PERSONAL NOTES

DR. GEORGE WALD and DR. L. S. PALMER have been awarded, by the American Chemical Society, the Eli Lilly and Co. award in biological chemistry and the Borden Co. award for "fundamental work in the field of biological chemistry" and for "achievement in research in the chemistry of milk," respectively.

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MESSRS. GEORGE BREARLEY, B.Sc., A.I.C., GEORGE DRING, M.A., B.Sc., F.I.C., KEITH FRASER, M.A., A.M.Inst.C.E., JOHN MCLAUGHLAN, M.Sc., ALFRED J. PRINCE, M.Sc., F.I.C., and FREDERICK J. ROBINSON, A.I.C. were recently elected members of the Institution of Chemical Engineers.

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MR. B. D. W. LUFF was elected chairman of the Liverpool section of the Society of Chemical Industry at the annual meeting on March 31. PROFESSOR T. P. HILDITCH was elected vice-chairman, MR. A. E. FINDLEY hon. treasurer, DR. G. P. GIBSON hon. recorder, and DR. L. G. BURRAGE hon. secretary.

OBITUARY

MR. CHARLES KEMP, a director of the Parkmore Lime Works, Dufftown, and of Keith Gas Co., died at his home at Dufftown on March 31.

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MR. ALEXANDER BRUCE, for many years with T. and H. Smith, Ltd., manufacturing chemists, Glasgow, died on March 31 at his home at Newton Mearne.

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DR. E. H. HANKIN, Sc.D., the well-known bacteriologist, died at his home near Brighton last week at the age of 74. After a distinguished career at Cambridge, where his bacteriological work marked him out as a possible leader among the younger scientists, and study under Koch in Berlin and Pasteur in Paris, Dr. Hankin accepted the post of bacteriologist and public analyst to the United Provinces and the Punjab.

TO-DAY'S ANNIVERSARY

AUGUST WILHELM VON HOFMANN was born on April 8, 1818. Apart from his outstanding association with the development of organic chemistry, Hofmann must be especially remembered in England, due to the fact that he was called to London in 1845 when the Royal College of Chemistry was established, and, at the instance of the Prince Consort, was made Superintendent of the College. For 20 years he taught and worked in London, and in addition to training students who eventually became leading English chemists of Victorian times, he also delivered lectures to working men upon chemistry and its influence in the work and life of the community. Hofmann originally intended to take up the practice of law, and in 1836 he entered the University at Giessen, where he was born. It was due to the influence of Liebig that he changed from law to chemistry. In 1865 he returned to Germany to occupy the Chair of Chemistry at the University of Berlin, previously occupied by Mitscherlich, and here he was intimately connected with the development of organic chemistry and did much for the ultimate founding of the German dye industry. He was raised to the status of a Prussian nobleman in 1888, on the occasion of his 70th birthday, and died on May 5, 1892. A memorial lecture was written for the Chemical Society in 1896. It was while Hofmann was a student in Liebig's laboratory at Giessen that he isolated a basic substance from coal tar, which he identified as being identical with a compound obtained by Unverdorben in 1826 and which we now know as aniline. He continued to investigate the properties of coal tar most energetically when he took up his teaching post in London, and one of the first results of this work was the discovery of benzene in the tar, duly reported in a communication to the *Annalen* in 1845. It was C. B. Mansfield, a student of Hofmann, who succeeded in isolating benzene in quantity from the light oil fraction of coal tar by further fractional distillation, in 1845.

References to Current Literature

Inorganic

Electrolytic production of hydrogen gas. Steinbrecher, *Oil and Soap, 16,* 36-39.

Properties of nepheline syenite. Koenig, *J. Amer. Ceramic Soc., 22,* 35-38.

Anhydrous chlorides, manufacture and properties. Kroll, *Metall u. Erz, 36,* 101-106.

Sensitivity of chemical reactions: the anions. Karaoglanov, *Z. analyt. Chem., 115,* 305-331.

Titanium and nickel in the ash from coals. Jones and Miller, *Chem and Ind., 58,* 237-245.

Organic

Reactions of carbon tetrachloride. Hofmann, *Angew Chem., 52,* 96-100.

Manufacture of chlorine-containing vat dyestuffs. Ruggli and Zaeslin, *Helv. Chim. Acta, 22,* 134-139.

Oxidation of phenol with hydrogen peroxide. Chwala and Pailer, *J. prakt. Chem., 152,* 45-48.

Hydrogenation of anthracene. Waterman, Leendertse and Crauendouk, *Rec. Trav. Chim. Pays-Bas, 58,* 83-92.

Fluorescence and chemical constitution. Mum, *Ber., 72,* 29-35.

Vinyl amines. Krabbe, Schmidt and Polzin, *Ber., 72,* 381-390.

Hydrogenation of ethane on cobalt catalysts. Taylor and Taylor, *J. Amer. Chem. Soc., 61,* 265-270.

Analysis

Hygroscopic substances in micro-analysis. Alber, *Microchem., 25,* 47-56, 167-181.

Lead peroxide in micro element analysis. Lindner, *Microchem., 25,* 197-207.

Determination of carbonyl compounds. Iddles, Low, Rosen and Hart, *Ind. Eng. Chem. analyt. ed., 11,* 102-103.

Chemical analysis of zinc chromes. Jameson, *Paint Manuf., 9,* 52-53.

Iodometric determination of small quantities of glucose. Noyons, *Rec. Trav. Chim. Pays-Bas, 58,* 17-22.

Thiosulphate titration of chlorine. Halliman and Thompson, *J. Amer. Chem. Soc., 61,* 265-270.

Quantitative determination of arsenic. Lewis and Davis, *J.C.S.,* 1939, 284-286.

Determining sulphur in surface-active agents. Hart, *Amer. Dyestuff Reporter, 28,* P 66-69.

Spectrography in the non-ferrous metallurgical industry. Twyman, *Monthly J. Inst. Metals, 6,* 105-114.

Analysis of hydrocarbons. Grosse-Oetringhaus, *Petroleum Z., 35,* 112-114.

Mineral Oils, Gas, Tar

Water resistance and the methanol and ethanol content of petrols. Heyden, Marder and Tschirpig, *Angew Chem., 52,* 168-171.

Halogenation and oxidation in oil refining. Mönnig, *Chem. Ztg., 63,* 145-148.

Reaction kinetics of "knocking" in motors. Jost and Müffling, *Z. Elektrochem., 45,* 93-99.

Synthesis of paraffin from carbon monoxide and hydrogen. Fischer and Pichler, *Ber., 72,* 327-330.

Salts in crude oil. Roberts, *Petroleum Refiner, 10,* No. 5, 37-42.

Determination of gum in oils heavier than kerosene. Smith and Shannon, *Refiner, 18,* No. 2, 53.

Cellulose, Paper

Sulphite pulping of Douglas fir. Brookbank, *Paper Trade J., 108,* No. 7, 30-38.

Properties of cellulose formate. Bluma, *Rev. Générale Matières Plastiques, 15,* 9-11.

Regenerated celluloses. Meyer, Mirsch and Badenhuizen, *Helv. Chim. Acta, 22,* 59-65.

Oxycellulose. Müller, *Helv. Chim. Acta, 22,* 208-224.

Solvent action of cuprammonium solutions. Jolley, *J. Text. Inst., 30,* T4-21.

Bleaching, Dyeing, Finishing

Naphthenic acid soaps. Minisch and Levinson, *Text. Imp. Blanch. App., 17,* 19-23.

Chemical constitution of the naphthol AS type dyes. Dorman, *Amer. Dyestuff Reporter, 28,* 79-106.

Talloil in textile finishing. Kollmann, *Melliand Textilber., 20,* 129-131.

Quaternary compounds as textile finishes. Gerber, *Melliand Textilber., 20,* 143-144.

Glass, Ceramics

Observations on crazing. Webb, *Trans. Brit. Ceram. Soc., 38,* 75-121.

Water in crude clay minerals. Keppeln and Aurich, *Sprechsaal, 72,* 71-75, 83-86, 93-95 and 109-113.

Antimony sulphide ruby glasses. Parkin, *Glass Rev., 15,* 17-20.

Metals, Electrometallurgy

Oxide films on aluminium. Pullen, *Metal Ind., 54,* 327-329.

Properties and uses of calcium. Manteil and Hardy, *Metals and Alloys, 10,* 52-56.

New methods for obtaining light metals. Grothe, *Metall u. Erz, 36,* 63-72.

Reaction inhibiting action of additions of hexamethylenetetramine to solutions. Roch and Röhrig, *Aluminium (Germany), 21,* 31-33.

Corrosion protection of magnesium alloys. Nachtigall, *Korrosion u. Metallschutz., 15,* 43-48.

Lead segregation in nickel bronzes. Maréchal, *Metal Ind., 54,* 339-340.

Fats, Oils, Waxes

Fatty acids by oxidation of paraffin. Wietzel, *Fette u. Seifen, 46,* 21-25.

Ageing tests for soap. Hitchcock and Divine, *Oil and Soap, 16,* 6-10.

Catalysts for hydrogenation. Gwynn, *Oil and Soap, 16,* 25-28.

Paints, Pigments

Swelling properties and permanence of paint films. Blom, *Farben Ztg., 44,* 161-163, 188-190.

Thermo-hardening phenolic resins in the lacquer industry. Hönel, *Fette u. Seifen, 46,* 29-33.

Colloids and the paint and varnish industry. Moore, *Paint Oil Chem. Rev., 101,* No. 3, 7-10, 34.

Red lead. Causer, *Oil Col. Trades J., 95,* 856-862.

Molybdenum orange pigments. Linz, *Ind. Eng. Chem., 31,* 298-306.

Nitrocellulose lacquers for special purposes. Kraus, *Nitrocellulose, 10,* 23-24.

Influence of drying conditions on paint durability. *Paint Varnish Prod. Manager, 19,* 102-106.

Rubber, Resins, Plastics

Determining the resistance of rubber to rubbing. Schloback and Bussen, *Kautschuk, 15,* 27-31.

Ultra rapid vulcanisation at high temperatures. Thiollet, *Rev. Générale Caoutchouc, 15,* 363-368.

Developments in plastics. Mienes, *Kunststoffe, 29,* 4-8.

Determining the water permeability of artificial resins. Schröder, *Kunststoffe, 29,* 44-45.

Rubber in chemical equipment. Brazier and Thompson, *Trans. Inst. Rubber Ind., 14,* 162-190.

Properties of chlorinated rubber. Barron, *Brit. Plastics, 10,* 520-522.

Ultrafiltration of rubber solutions. Meyer and Jeannerat, *Helv. Chim. Acta, 22,* 19-22.

Influence of surface-active substance upon the structure of rubber solutions. Margaritov, *Acta Physicochem., 9,* 915-926.

Miscellaneous

Surface tension and the evaporation of liquids. Claasen, *Chem. Fabrik,* 51-54.

General News

ROWNTREE AND CO., LTD., are spending over £10,000 on A.R.P. shelters and trenches at their York factory, according to a statement made by Mr. B. Seebohm Rowntree, chairman of the company.

APEX CONSTRUCTION, LTD., have been appointed by Birmingham Electric Furnaces, Ltd., as representatives for the sale of Birlec 'Lectrodryers (machines for removing moisture from gases and certain liquids by means of activated alumina).

AN INTERNATIONAL CONGRESS of Benzol Producers is to be held on June 22 and 23, at the Liege International Exhibition of 1939. All particulars can be obtained from M. C. Petit, 103 Bd. Waterloo, Brussels. The Liege Exhibition is being held from May to November.

EMPLOYEES OF THE BRITISH DRUG HOUSES, LTD., who are now serving in, or who subsequently join, the Territorial Army will be released for attendance at the annual summer camp, and will be granted, in addition, their normal period of holidays. Payment of wages and salaries will be at full rates during camp and holidays.

THE BILL to amend the Indian Tariff Act to meet the requirements of the Indo-British Trade Agreement was introduced into the Legislative Assembly on March 31. According to a report from Delhi this implies that the Government of India are fulfilling the Agreement in spite of the opposition of the Assembly, which rejected it.

IN ORDER TO BRING TO THE NOTICE of young people the importance of metallurgy in the industrial life of this country, and also the educational facilities provided therewith, the Sir John Cass Technical Institute has issued a booklet entitled "Metallurgy as a Career" for distribution to those who may be interested. The Institute is endeavouring to play its part in meeting the demand for young men and women who have been suitably trained in certain branches of metallurgy, by providing full-time day courses in this subject.

NAVALIUM, a new light-alloy metal made of aluminium and magnesium, was discussed as the future material for ship construction by the Institution of Naval Architects at a meeting in London last week. During the discussion it was announced that the aluminium industry would finance a research scholarship of the value of £250 a year for young naval architects in order that problems arising out of the use of Navalium in shipyards might be fully investigated. In a paper which was read it was stated that recent tests went to show that the corrosion of steel was five times as rapid as that of the Navalium alloy.

PRODUCTION OF POTASH SALTS in the United States in 1938 exceeded half a million tons, according to the U.S. Bureau of Mines. Sales of domestic salts in terms of actual potash (K_2O) in 1938 increased 7 per cent. in quantity over 1937 to 286,437 short tons valued at $9,748,290 from 266,938 tons with a value of $9,019,534 in 1937. Imports declined to 194,659 tons K_2O in 1938 from 351,445 tons K_2O in 1937. Exports of potash fertiliser materials in 1938 fell sharply to 84,137 short tons, from 103,031 tons in 1937; the value likewise dropped from $3,278,895 in 1937 to $2,599,772 in 1938. Exports of potassium salts (not fertiliser) in 1938 were considerably larger than in 1937 in quantity, but only slightly larger in value. During the year three of the American producers of potash formed the Potash Export Association to facilitate foreign sales of domestic potash under the Webb-Pomerene export trade act.

OPPOSITION TO THE COTTON INDUSTRY (REORGANISATION) BILL in its present form is expressed in a memorandum issued by the Rayon Producers' Section of the Silk Association of Great Britain and Ireland, which is now being reconstituted as the Rayon and Silk Association. The eight firms mentioned in the memorandum, who claim to represent 98 per cent. of the total British production of rayon yarn and staple fibre, are the following: Breda Visada, Ltd., British Bemberg, Ltd., British Celanese, Ltd., British Enka Artificial Silk Co., Ltd., Courtaulds, Ltd., Harbens (V.S.M.), Ltd., Lansil, Ltd., and North British Rayon, Ltd. Their case is that under the provisions of the Bill, the use of rayon in the loom and all subsequent processes will be controlled by cotton interests with statutory powers. They contend that rayon should be recognised as a separate industry of national importance, and that its power of expansion and development should not be made subservient to cotton or any other fibre.

From Week to Week

THE DEPARTMENT OF OVERSEAS TRADE announce that next year's British Industries Fair will be held in London and Birmingham from February 19 to March 1. It is reported that already, within four weeks of the close of the Fair, 576 exhibitors have applied for 224,313 sq. ft. of space in London and Birmingham in 1940, or more than one fourth of the area occupied this year.

IN THE PRESENCE OF NUMEROUS EMPLOYEES presentations were made to Mr. F. W. Hampshire, chairman and managing director of F. W. Hampshire and Co., Ltd., manufacturing chemists, during the firm's annual dance at Derby, on March 28. The presentations were made to Mr. Hampshire on behalf of past and present directors of the firm, the office and works' staff and the sales staff. Presentations were also made to seven employees of the firm with more than 25 years' service.

WE ARE INFORMED by the Midland Tar Distillers, Ltd., that at the recent luncheon of the Midland District Tar Board, Mr. D. W. Parkes, head of the research department of the company, gave a running commentary during the exhibition of the British Road Tar Association's film, "Tar Carpets," and did not, as we reported in our "Personal Notes" last week, supervise the showing of a film illustrating the methods of testing tar and tar materials in the Nechells laboratories of the company.

MR. J. B. GREAVES, H.M. Trade Commissioner at Toronto, will be at the Department of Overseas Trade on Tuesday to Friday, April 25-28 inclusive, for the purpose of interviewing manufacturers and merchants interested in the export of United Kingdom goods to Canada. Subsequently the Trade Commissioner will undertake a tour of some of the principal industrial centres in the provinces. Firms who desire interviews with Mr. Greaves in London or wish to obtain information regarding his arrangements to visit the provinces should apply to the Department of Overseas Trade, 35 Old Queen Street, London, S.W.1, quoting reference 900/39.

Chemical Trade Inquiries

The following trade inquiries are abstracted from the "Board of Trade Journal." Names and addresses may be obtained from the Department of Overseas Trade (Development and Intelligence), 35 Old Queen Street, London, S.W.1 (quote reference number).

Poland.—An agent in Lodz wishes to obtain the representation, both on a commission basis and buying for his own account, of United Kingdom manufacturers of aniline dyes and chemicals for the textile industry. (Ref. No. 249.)

Portugal.—A firm of agents established at Oporto wishes to obtain the representation, on a commission basis, of United Kingdom manufacturers of fine chemicals for the pharmacy trade for Portugal. (Ref. No. 250.)

British West Indies.—A well-established firm of agents at Kingston, Jamaica, wishes to obtain the representation for Jamaica, on a commission basis, of United Kingdom manufacturers of proprietary medicines, drugs and druggists' sundries. It is understood that they are also prepared to buy for stock. (Ref. No. 237.)

Canada.—A well-established agent at Vancouver wises to obtain the representation, on a commission or consignment basis, of United Kingdom manufacturers of chemicals, toilet preparations. (Ref. No. 240.)

Forthcoming Events

London.

April 18.—Institution of Chemical Engineers. Burlington House, Piccadilly, W.1. 6 p.m. E. S. Byng, "Administrative Training for the Chemical Engineer."

April 19.—Electrodepositors' Technical Society. Northampton Polytechnic Institute, St. John Street, E.C.1. 8 p.m. Symposium on "Bright Nickel Plating."

Liverpool.

April 13.—Institute of Chemistry. Reece's Restaurant, Parker Street. 7.30 p.m. Annual General Meeting. Dr. D. A. Allan, "Chemistry in the Museum Service."

Manchester.

April 17.—Institution of the Rubber Industry. Engineers' Club, Albert Square. 7.30 p.m. Annual General Meeting.

Books Received

The Chemical Formulary. Vol. 4. H. Bennett, editor-in-chief. London: Chapman and Hall, Ltd. Pp. 632. 25s.

Weekly Prices of British Chemical Products

ALTHOUGH trade is not very brisk quite a steady demand has been maintained for industrial chemicals this week and market conditions are surprisingly good considering the uncertainty in European political affairs. The price position remains very steady and quotations for general chemicals, rubber chemicals and wood distillation products are mostly unchanged at recent levels. There is still room for improvement in the market for coal tar products, the bulk of the business this week being confined to home trade. The demand for toluol and xylol has been quite good and prices for these products are firm. Values in other directions are steady with quotations for contract qualities competitive.

Price Changes

Falls: Pitch, medium, soft (Manchester); Copper Sulphate (Manchester).

MANCHESTER.—The undertone of the Manchester chemical market at the moment of writing is a little brighter than it was a week ago, although fresh bookings in most of the leading heavy products have been no more than moderate. There are, however, fair contract deliveries being taken up and the tendency in respect of these appears to be towards a gradual improvement, although during the next week there will be the usual seasonal interruption. The price position as a whole remains steady to firm. In the tar products market the xylols and one or two other light distillates are well held and in steady demand, but business in the other sections has continued rather quiet.

General Chemicals

ACETONE.—£39 to £43 per ton, according to quantity.

ACETIC ACID.—Tech, 80%, £30 5s. per ton; pure 80%, £32 5s.; tech., 40%, £15 12s. 6d. to £18 12s. 6d.; tech., 60%, £23 10s. to £25 10s. MANCHESTER: 80%, commercial, £30 5s.; tech. glacial, £42 to £46.

ALUM.—Loose lump, £8 7s. 6d. per ton d/d; GLASGOW: Ground, £10 7s. 6d. per ton; lump, £9 17s. 6d.

ALUMINIUM SULPHATE.—£7 5s. 0d. per ton d/d Lancs. GLASGOW: £7 to £8 ex store.

AMMONIA, ANHYDROUS.—Spot, 1s. to 1s. 1d. per lb. d/d in cylinders. SCOTLAND: 10½d. to 1s. 0½d., containers extra and returnable.

AMMONIA, LIQUID.—SCOTLAND: 80°, 2½d. to 3d. per lb., d/d.

AMMONIUM CARBONATE.—£20 per ton d/d in 5 cwt. casks

AMMONIUM CHLORIDE.—Grey, £17 10s. per ton, d/d U.K. Fine white, 98%, £16 per ton, d/d U.K.

AMMONIUM CHLORIDE (MURIATE).—SCOTLAND: British dog tooth crystals, £32 to £35 per ton carriage paid according to quantity. (See also Salammoniac.)

AMMONIUM DICHROMATE.—8½d. per lb. d/d U.K.

ANTIMONY OXIDE.—£68 per ton.

ARSENIC.—Continental material £11' per ton c.i.f., U.K. ports; Cornish White, £12 5s. to £12 10s. per ton f.o.r., mines, according to quantity. MANCHESTER: White powdered Cornish, £16 per ton, ex store.

BARIUM CHLORIDE.—£11 10s. to £12 10s. per ton in casks ex store. GLASGOW: £12 per ton.

BLEACHING POWDER.—Spot, 35/37%, £9 5s. per ton in casks, special terms for contract. SCOTLAND: £9 5s. per ton net ex store.

BORAX COMMERCIAL.—Granulated, £16 per ton; crystal, £17; powdered, £17 10s.; extra finely powdered, £18 10s., packed in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Granulated, £16, crystal, £17; powdered, £17 10s. per ton in 1-cwt. bags, carriage paid.

BORIC ACID.—Commercial granulated, £28 10s. per ton; crystal, £29 10s.; powdered, £30 10s.; extra finely powdered, £32 10s. in 1-cwt. bags, carriage paid home to buyers' premises within the United Kingdom in 1-ton lots. GLASGOW: Crystals, £29 10s.; powdered, £30 10s. 1-cwt. bags in 1-ton lots.

CALCIUM BISULPHITE.—£6 10s. per ton f.o.r. London.

CHARCOAL, LUMP.—£6 to £6 10s. per ton, ex wharf. Granulated, £7 to £9 per ton according to grade and locality.

CHLORINE, LIQUID.—£18 15s. per ton, seller's tank wagons, carriage paid to buyer's sidings; £19 5s. per ton, d/d in 16/17 cwt. drums (3-drum lots); £19 10s. per ton d/d in 10-cwt. drums (4-drum lots); 4⅝d. per lb. d/d station in single 70-lb. cylinders.

CHROMETAN.—Crystals, 2⅝d. per lb.; liquor, £13 per ton d/d station in drums. GLASGOW: 70/75% solid, £5 15s. per ton net ex store.

CHROMIC ACID.—9d. per lb., less 2½%; d/d U.K.

CHROMIC OXIDE.—11½d. per lb.; d/d U.K.

CITRIC ACID.—1s. 0½d. per lb. MANCHESTER: 1s. 0½d. SCOTLAND: B.P. crystals, 1s. 0½d. per lb.; less 5%, ex store.

COPPER SULPHATE.—£18 5s. per ton, less 2% in casks. MANCHESTER: £19 per ton f.o.b. SCOTLAND: £19 10s. per ton, less 5%, Liverpool in casks.

CREAM OF TARTAR.—100%, 92s. per cwt., less 2½%. GLASGOW: 99%, £4 12s. per cwt. in 5-cwt. casks.

FORMALDEHYDE.—£20-£22 per ton.

FORMIC ACID.—85%, in carboys, ton lots, £42 to £47 per ton.

GLYCERINE.—Chemically pure, double distilled, 1.260 s.g., in tins, £3 10s. to £4 10s. per cwt. according to quantity; in drums, £3 2s. 6d. to £3 16s. 0d. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

HYDROCHLORIC ACID.—Spot, 5s. 6d. to 8s. carboy d/d according to purity, strength and locality.

IODINE.—Resublimed B.P., 6s. 9d. per lb. in 7 lb. lots.

LACTIC ACID.—(Not less than ton lots). Dark tech., 50% by vol., £24 10s. per ton; 50% by weight, £28 10s.; 80% by weight, £50; pale tech., 50% by vol., £28; 50% by weight, £33; 80% by weight, £55; edible, 50%, by vol., £41. One-ton lots ex works, barrels free.

LEAD ACETATE.—LONDON: White, £31 10s. ton lots; brown, £35. GLASGOW: White crystals, £29 10s.; brown, £1 per ton less. MANCHESTER: White, £31; brown, £30.

LEAD, NITRATE.—£32 per ton for 1-ton lots.

LEAD, RED.—£30 15s. 0d. 10 cwt. to 1 ton, less 2½% carriage paid. SCOTLAND: £30 per ton, less 2½% carriage paid for 2-ton lots.

LITHARGE.—SCOTLAND: Ground, £30 per ton, less 2½ %, carriage paid for 2-ton lots.

MAGNESITE.—Calcined, in bags, ex works, about £8 per ton. SCOTLAND: Ground calcined, £9 per ton, ex store.

MAGNESIUM CHLORIDE.—Solid (ex wharf) £5 10s. per ton. SCOTLAND: £7 5s. per ton

MAGNESIUM SULPHATE.—Commercial, £5 10s. per ton, ex wharf.

MERCURY.—Ammoniated B.P. (white precip.), lump, 6s. 5d. per lb.; powder B.P., 6s. 7d.; bichloride B.P. (corros. sub.), 5s. 8d.; powder B.P. 5s. 4d.; chloride B.P. (calomel), 6s. 5d.; red oxide cryst. (red precip.), 7s. 6d.; levig., 7s.; yellow oxide B.P. 6s. 10d.; persulphate white B.P.C., 6s. 7d.; sulphide black (hyd. sulph. cum. sulph. 50%), 6s. 6d. For quantities under 112 lb., 1d. extra; under 28 lb., 5d. extra.

METHYLATED SPIRIT.—61 O.P. industrial, 1s. 5d. to 2s. per gal.; pyridinised industrial, 1s. 7d. to 2s. 2d.; mineralised, 2s. 6d. to 3s. Spirit 64 O.P. is 1d. more in all cases and the range of prices is according to quantities. SCOTLAND: Industrial 64 O.P., 1s. 9d. to 2s. 4d.

NITRIC ACID.—Spot, £25 to £30 per ton according to strength, quantity and destination.

OXALIC ACID.—£48 15s. to £57 10s. per ton, according to packages and position. GLASGOW: £2 9s. per cwt. in casks. MANCHESTER: £49 to £55 per ton ex store.

PARAFFIN WAX.—SCOTLAND: 3½d. per lb.

POTASH, CAUSTIC.—Solid, £33 5s. to £38 per ton according to quantity, ex store; broken, £40 per ton. MANCHESTER: £38.

POTASSIUM CHLORATE.—£36 7s. 6d. per ton. GLASGOW: 4½d. per lb. MANCHESTER: £37 per ton.

POTASSIUM DICHROMATE.—5½d. per lb. carriage paid. SCOTLAND: 5½d. per lb., net, carriage paid.

POTASSIUM IODIDE.—B.P. 6s. 3d. per lb. in 7 lb. lots.

POTASSIUM NITRATE.—Small granular crystals, £24 to £27 per ton ex store, according to quantity. GLASGOW: Refined granulated, £29 per ton c.i.f. U.K. ports. Spot, £30 per ton ex store.

POTASSIUM PERMANGANATE.—LONDON: 9½d. to 10½d. per lb. SCOTLAND: B.P. Crystals, 10½d. MANCHESTER: B.P. 9½d. to 11½d.

POTASSIUM PRUSSIATE.—5½d. to 6d. per lb. SCOTLAND: 6½d. net, in casks, ex store. MANCHESTER: Yellow, 6d. to 6½d.

PRUSSIATE OF POTASH CRYSTALS.—In casks, 6½d. per lb. net, ex store

SALAMMONIAC.—Firsts lump, spot, £42 17s. 6d. per ton, d/d address in barrels. Dog-tooth crystals, £35 per ton; fine white crystals, £18 per ton, in casks, ex store. GLASGOW: Large crystals, in casks, £37 10s.

SALT CAKE.—Unground, spot, £3 8s. 6d. per ton.

SODA ASH.—Light 98/100%, £5 17s. 6d. per ton f.o.r. in bags.

SODA, CAUSTIC.—Solid, 76/77° spot, 13s. 10s. per ton d/d station. SCOTLAND: Powdered 98/99%, £18 10s. in drums, £19 5s. in casks, Solid 76/77° £15 12s. 6d. in drums; 70/73%, £15 12s. 6d., carriage paid buyer's station, minimum 4-ton lots; contracts, 10s. per ton less.

SODA CRYSTALS.—Spot, £5 to £5 5s. per ton d/d station or ex depot in 2-cwt. bags.

SODIUM ACETATE.—£19-£20 per ton carriage paid North. GLASGOW: £18 10s. per ton net ex store.

SODIUM BICARBONATE.—Refined spot, £10 10s. per ton d/d station in bags in 1-ton lots. GLASGOW: £13 5s. per ton in 1 cwt. kegs, £11 5s. per ton in 2-cwt. bags. MANCHESTER: £10 15s.

SODIUM BISULPHITE POWDER.—60/62%, £12 10s. to £14 per ton d/d in 2-ton lots for home trade.

SODIUM CARBONATE MONOHYDRATE.—£20 per ton d/d in minimum ton lots in 2 cwt. free bags.

SODIUM CHLORATE.—£27 10s. to £32 per ton. GLASGOW: £1 11s. per cwt., minimum 3 cwt. lots.

SODIUM DICHROMATE.—Crystals cake and powder 4½d. per lb. net d/d U.K. with rebates for contracts.

SODIUM CHROMATE.—4½d. per lb. d/d U.K. 4d. per lb. GLASGOW: 4½d. net, carriage paid.

SODIUM HYPOSULPHITE.—Pea crystals, £15 5s. per ton for 2-ton lots; commercial, £11 5s. per ton. MANCHESTER: Commercial, £11; photographic, £15 10s.

SODIUM METASILICATE.—£14 5s. per ton, d/d U.K. in cwt. bags.

SODIUM NITRATE.—Refined, £8 per ton for 6-ton lots d/d. GLASGOW: £1 12s. 0d. per cwt. in 1-cwt kegs, net, ex store.

SODIUM NITRITE.—£18 5s. per ton for ton lots.

SODIUM PERBORATE.—10%, £4 per cwt. d/d in 1-cwt. drums.

SODIUM PHOSPHATE.—Di-sodium, £12 per ton delivered for ton lots. Tri-sodium, £16 10s. per ton delivered per ton lots.

SODIUM PRUSSIATE.—4d. per lb. for ton lots. GLASGOW: 4d. MANCHESTER: 4½d. to 5d.

SODIUM SILICATE.—£8 2s. 6d. per ton.

SODIUM SULPHATE (GLAUBER SALTS).—£3 per ton d/d.

SODIUM SULPHATE (SALT CAKE).—Unground spot, £3 to £3 10s per ton d/d station in bulk. SCOTLAND: Ground quality, £3 5s. per ton d/d. MANCHESTER: £3 10s.

SODIUM SULPHIDE.—Solid 60/62%, Spot, £11 15s. per ton d/d in drums; crystals, 30/32%, £9 per ton d/d in casks. MANCHESTER: Concentrated solid, 60/62%, £11; commercial, £8 10s.

SODIUM SULPHITE.—Pea crystals, spot, £14 10s. per ton d/d station in kegs.

SULPHUR PRECIP.—B.P., £55 to £60 per ton according to quantity. Commercial, £50 to £55.

SULPHURIC ACID.—168° Tw., £4 11s. to £5 1s. per ton; 140° Tw., arsenic-free, £3 to £3 10s.; 140° Tw., arsenious, £2 10s.

TARTARIC ACID.—1s. 1½d. per lb. less 5%, carriage paid for lots of 5 cwt. and upwards. MANCHESTER: 1s. 1½d. per lb. GLASGOW: 1s. 1½d. per lb., 5%, ex store.

ZINC SULPHATE.—Tech., £11 10s. f.o.r., in 2 cwt. bags.

Rubber Chemicals

ANTIMONY SULPHIDE.—Golden, 7d. to 1s. 2d. per lb., according to quality. Crimson, 1s. 6d. to 1s. 7½d. per lb.

ARSENIC SULPHIDE.—Yellow, 1s. 5d. to 1s. 7d. per lb.

BARYTES.—£6 to £6 10s. per ton, according to quality.

CADMIUM SULPHIDE.—3s. 0d. to 3s. 3d. per lb.

CARBON BLACK.—3⅞d. to 4 1/16d. per lb., ex store.

CARBON DISULPHIDE.—£31 to £33 per ton, according to quantity, drums extra.

CARBON TETRACHLORIDE.—£41 to £46 per ton, according to quantity, drums extra.

CHROMIUM OXIDE.—Green, 10½d. to 11½d. per lb.

DIPHENYLGUANIDINE.—2s. 2d. per lb.

INDIA-RUBBER SUBSTITUTES.—White, 4¼d. to 5d. per lb.; dark 3⅝d. to 4⅜d. per lb.

LAMP BLACK.—£24 to £26 per ton del., according to quantity. Vegetable black, £35 per ton upwards.

LEAD HYPOSULPHITE.—9d. per lb.

LITHOPONE.—Spot, 30%, £16 10s. per ton, 2-ton lots d/d in bags.

SULPHUR.—£9 to £9 5s. per ton. SULPHUR PRECIP. B.P., £55 to £60 per ton. SULPHUR PRECIP. COMM., £50 to £55 per ton.

SULPHUR CHLORIDE.—5d. to 7d. per lb., according to quantity.

VERMILION.—Pale, or deep, 5s. per lb., 1-cwt. lots.

ZINC SULPHIDE.—£58 to £60 per ton in casks ex store, smaller quantities up to 1s. per lb.

Nitrogen Fertilisers

AMMONIUM SULPHATE.—The following prices have been announced for neutral quality basis 20.6% nitrogen, in 6-ton lots delivered farmer's nearest station up to June 30, 1939; November, £7 8s.; December, £7 9s. 6d.; January, 1939; £7 11s.; February, £7 12s. 6d.; March/June, £7 14s.

CALCIUM CYANAMIDE.—The following prices are for delivery in 5-ton lots, carriage paid to any railway station in Great Britain up to June 30, 1939; November, £7 12s. 6d.; December, £7 13s. 9d.; January, 1939, £7 15s.; February, £7 16s. 3d.; March, £7 17s. 6d.; April/June, £7 18s. 9d.

NITRO CHALK.—£7 10s. 6d per ton up to June 30, 1939.

SODIUM NITRATE.—£8 per ton for delivery up to June 30, 1939.

CONCENTRATED COMPLETE FERTILISERS.—£11 4s. to £11 13s. per ton in 6-ton lots to farmer's nearest station.

AMMONIUM PHOSPHATE FERTILISERS.—£10 19s. 6d. to £14 16s. 6d. per ton in 6-ton lots to farmer's nearest station.

Coal Tar Products

BENZOL.—At works, crude, 9½d. to 10d. per gal.; standard motor, 1s. 3½d. to 1s. 4d.; 90%, 1s. 4½d. to 1s. 5d., pure 1s. 8½d. to 1s. 9d. GLASGOW: Crude, 10d. to 10½d. per gal.; motor, 1s. 4d. to 1s. 4½d. MANCHESTER: Pure, 1s. 8d. to 1s. 8½d. per gal.; crude 11d. to 11½d. per gal.

CARBOLIC ACID.—Crystals, 6⅜d. to 7⅞d. per lb., small quantities would be dearer; Crude, 60's, 1s. 7½d. to 1s. 10d.; dehydrated, 2s. 6d. per gal., according to specification; Pale, 99/100%, per lb. f.o.b. in drums; crude, 2s. 1d. per gal.

CREOSOTE.—Home trade, 3½d. to 4d. per gal., f.o.r., makers' works; exports 6d. to 6¼d. per gal., according to grade. MANCHESTER: 3d. to 3¾d. GLASGOW: B.S.I. Specification, 6d. to 6¼d. per gal.; washed oil, 5d. to 5½d.; lower sp. gr. oils, 5¾d. to 6¼d.

CRESYLIC ACID.—97/99%, 1s. 4d. to 1s. 7d.; 99/100%, 1s. 9d. to 2s. 6d. per gal., according to specifications; Pale, 99/100%, 1s. 6d. to 1s. 8d.; Dark, 95%, 1s. 2d. to 1s. 4d. per gal. GLASGOW: Pale, 99/100%, 5s. to 5s. 6d. per gal.; pale, 97/99%, 4s. 6d. to 4s. 10d., dark, 97/99%, 4s. 3d. to 4s. 6d.; high boiling acids, 2s. to 2s. 6d. American specification 3s. 9d. to 4s. MANCHESTER: Pale, 99/100%, 1s. 9d. to 1s. 10d.

NAPHTHA.—Solvent, 90/160, 1s. 6d. to 1s. 7d. per gal.; solvent, 95/160%, 1s. 7d. to 1s. 8d., naked at works; heavy 90/190%, 1s. 1½d. to 1s. 3d. per gal., naked at works, according to quantity. MANCHESTER: 90/160%, 1s. 5d. to 1s. 7d. per gal. GLASGOW: Crude, 6½d. to 7½d. per gal.; 90%, 160, 1s. 5d. to 1s. 6d., 90%, 190, 1s. 1d. to 1s. 3d.

NAPHTHALENE.—Crude, whizzed or hot pressed, £4 10s. to £5 10s. per ton; purified crystals, £9 10s. per ton in 2-cwt. bags. LONDON: Fire lighter quality, £3 to £4 10s. per ton. GLASGOW: Fire lighter, crude, £6 to £7 per ton (bags free). MANCHESTER: Refined, £10 10s. to £11 10s. per ton f.o.b.

PITCH.—Medium, soft, 27s. 6d. per ton, f.o.b. MANCHESTER: 25s. f.o.b., East Coast. GLASGOW: f.o.b. Glasgow, 35s. to 37s. per ton; in bulk for home trade, 35s.

PYRIDINE.—90/140%, 12s. 6d. to 14s. per gal.; 90/160%, 10s. 6d. to 11s. 6d. per gal.; 90/180%, 3s. to 4s. per gal. f.o.b. GLASGOW: 90% 140, 10s. to 12s. per gal.; 90% 160, 9s. to 10s.; 90% 180. 2s. 6d. to 3s. MANCHESTER: 11s. to 14s. per gallon.

TOLUOL.—90%, 1s. 11d. to 2s. per gal; pure 2s. 3d. to 2s. 4d. GLASGOW: 90% 120, 1s. 10d. to 2s. 1d. per gal. MANCHESTER: Pure, 2s. 4d. per gallon, naked.

XYLOL.—Commercial, 2s. 2d. per gal.; pure, 2s. 4d. GLASGOW: Commercial, 2s. to 2s. 1d. per gal.

Wood Distillation Products

CALCIUM ACETATE.—Brown, £6 15s. to £9 5s. per ton; grey, £8 to £8 5s. MANCHESTER: Brown, £8; grey, £9 10s.

METHYL ACETONE.—40.50%, £32 to £35 per ton.

WOOD CREOSOTE.—Unrefined, 6d. to 8d. per gal., according to boiling range.

WOOD NAPHTHA, MISCIBLE.—2s. 8d. to 3s. per gal.; solvent, 3s. to 3s. 5d. per gal.

WOOD TAR.—£3 to £8 per ton, according to quality.

Intermediates and Dyes

ANILINE OIL.—Spot, 8d. per lb., drums extra, d/d buyer's works.

ANILINE SALTS.—Spot, 8d. per lb. d/d buyer's works, casks free.

BENZIDINE, HCl.—2s. 7½d. per lb., 100% as base, in casks.

BENZOIC ACID, 1914 B.P. (ex toluol).—1s. 11½d. per lb. d/d buyer's works.

m-CRESOL 98/100%.—1s. 8d. to 1s. 9d. per lb. in ton lots.

o-CRESOL 30/31° C.—6½d. to 7½d. per lb. in 1-ton lots.

p-CRESOL, 34.5° C.—1s. 7d. to 1s. 8d. per lb. in ton lots.

DICHLORANILINE.—2s. 1½d. to 2s. 5½d. per lb.

DIMETHYLANILINE.—Spot, 1s. 7½d. per lb., package extra.

DINITROBENZENE.—7½d. per lb.

DINITROCHLORBENZENE, SOLID.—£79 5s. per ton.

DINITROTOLUENE.—48/50° C., 8½d. per lb.; 66/68° C., 11d.

DIPHENYLAMINE.—Spot, 2s. 2d. per lb., d/d buyer's works.

GAMMA ACID, Spot, 4s. 4½d. per lb. 100% d/d buyer's works.

H ACID.—Spot, 2s. 7d. per lb.; 100% d/d buyer's works.

NAPHTHIONIC ACID.—1s. 10d. per lb.

β-NAPHTHOL —£97 per ton; flake, £94 8s. per ton.

α-NAPHTHYLAMINE.—Lumps, 1s. 1d. per lb.

β-NAPHTHYLAMINE.—Spot, 3s. per lb.; d/d buyer's works.

NEVILLE AND WINTHER'S ACID.—Spot, 3s. 3½d. per lb. 100%.

o-NITRANILINE.—4s. 3½d per lb.

m-NITRANILINE.—Spot, 2s. 10d. per lb. d/d buyer's works.

p-NITRANILINE.—Spot, 1s. 10d. to 1s. 11d. per lb. d/d buyer's works.

NITROBENZENE.—Spot, 4½d. to 5d. per lb., in 90-gal. drums, drums extra. 1-ton lots d/d buyer's works.

NITRONAPHTHALENE.—9½d. per lb.; P.G., 1s. 0½d. per lb.

SODIUM NAPHTHIONATE.—Spot, 1s. 11d. per lb.; 100% d/d buyer's works.

SULPHANILIC ACID.—Spot, 8½d. per lb. 100%, d/d buyer's works.

o-TOLUIDINE.—10½d. per lb., in 8/10 cwt. drums, drums extra.

p-TOLUIDINE.—1s. 10½d. per lb., in casks.

m-XYLIDINE ACETATE.—4s. 3d. per lb., 100%.

Company News

The British Drug Houses, Ltd., have declared a dividend of 6 per cent., less tax (same). The net profit for the year is £49,790 (£58,068).

Van den Berghs and Jurgens, Ltd., margarine manufacturers, etc., who are controlled by Lever Bros. and Unilever, Ltd., report a rise in profits from £1,172,644 to £1,257,668, after charging management expenses and depreciation, etc. The carry-forward is £187,525 against £150,325. The final dividend is maintained at 8½ per cent. (same), making 12½ per cent. for the year.

Jenson and Nicholson, Ltd., manufacturers of varnishes and paints, etc., announce that trading profits, including interest, for the year ended December 31 have fallen from £78,832 to £65,629. Income tax and N.D.C. require £15,347 (£18,227), and after allowing for depreciation, etc., there remains a net profit of £31,007 (£42,840). The ordinary dividend is reduced from 15 per cent. to 10 per cent., while £2,000 (£6,500) is placed to general reserve. The carry-forward is £5,050 (£4,527).

United Glass Bottle Manufacturers, Ltd., report that for 1938 trading profits fell from £333,135 to £301,810. It is proposed to transfer £17,570 to debenture redemption reserve (£16,810), to repeat allocation to staff benevolent fund of £15,000, to reduce the amount transferred to general reserve from £60,000 to £50,000, and to apply £15,000 to special provision for package stores, compared with £20,000 for office equipment in the previous year. The distribution is maintained at 12 per cent., leaving £42,255 to go forward, compared with £44,738 brought in.

The Magadi Soda Co., Ltd.—Imperial Chemical Industries, Ltd., has made an offer to purchase the shares of the Magadi Soda Co. For the 6 per cent. first preference £1 shares, 4s. per share is offered; for the 6 per cent. second preference 5s. shares, 9d. per share is offered; and for the preferred ordinary 5s. shares, 1s. per share is offered. Imperial Chemical Industries reserves the right to withdraw the offer made to any class where that offer is not accepted by shareholders owning 90 per cent. in value of the shares affected. 93 per cent. of the holders of the first preference shares have already stated that they will accept the terms offered.

In a circular recommending acceptance of the offer the directors of the Magadi Soda Co. state that the net profit for 1938 amounted to £18,787, which represents an improvement of about £2,700 over the 1937 figure. The whole of this sum will, however, be absorbed in paying the debenture interest for 1938, even upon the reduced amount of debentures now outstanding, together with the arrears of interest due in respect of 1937. In view of the further decline which seems to be inevitable in the company's export trade, they add, it would appear that the development of salt sales and the possibility of a demand for substantial quantities of soda ash in local markets offer the only prospect of arresting a further drop in profits. They consider the offer is fair and reasonable in all respects.

William Blythe and Co., Ltd., have declared a final dividend of 7 per cent., making 10 per cent. (the same).

Midland Tar Distillers, Ltd., have decided to defer the dividend on the ordinary shares until the end of the financial year (an interim of 2½ per cent., tax free, was paid a year ago).

Stewarts and Lloyds, Ltd., the tube and pipe manufacturers, are maintaining the dividend for 1938 on the deferred stock and the liaison deferred shares at 12½ per cent. The dividends will be paid on or about May 20, less tax, at the rate then ruling.

Cellon, Ltd., are maintaining their distribution for 1938 at 20 per cent., less tax, with a final dividend of 12½ per cent. Trading profits increased from £38,744 to £39,439, and the net profit before allowing for tax and N.D.C., was £856 higher at £39,031. The carry-forward is raised by £2,254 to £6,843.

New Companies Registered

Detergents, Ltd. 348,811. Private company. Capital, £1,050 in 1,000 ordinary shares of 1s. and 1,000 10 per cent. participating preference of £1 each. To carry on the business of manufacturers of and dealers in chemical products, etc. Directors: Cornelius T. Pollard, 38 Westbourne Terrace, W.2; Pamela F. Savory, Wm. J. Castle. Registered office: Great Western Trading Estate, Park Royal Road, N.W.10.

Bardens (Bury), Ltd. 349,127.—Private company. Capital £20,000 in 20,000 shares of £1 each. To carry on the business of manufacturers and importers of and dealers in animal and vegetable glues, glue stocks, gelatines, gums, pastes, adhesives, sizes, soaps, greases, waterproofings, compositions, chemicals, and drugs, etc. Directors: Joseph Barden, "Woodsome," Stand Lane, Radcliffe, Lancs; Ellen L. Barden.

British Natural Resins, Ltd. 348,065.—Private company. Capital £100 in 100 "A" ordinary shares of £1 each. To carry on the business of manufacturers, importers and exporters of and dealers in treated and untreated shellacs, resins, gums, chemicals, etc. Directors: Walter E. W. Stroever, A.d. Muggenberg 1-2, Bremen, Germany; Reginald H. Cole; Wm. H. Wiles. Registered office: Spencer House, South Place, E.C.2.

Process Development Laboratory, Ltd. 349,198.—Private company. Capital £1,050 in 1,000 shares of £1 and 1,000 shares of 1s. To act as consultants to any industry; to acquire and develop processes and letters patent, to develop new materials and to find applications for such materials; and to carry on the business of manufacturers of and wholesale and retail dealers in chemicals, gases and disinfectants, etc. Subscribers: John E. O. Mayne, 21 Lansdowne Road, Luton, Beds; Sidney R. Mayne. Registered office: 23 Tyneham Road, S.W.11.

Chemical and Allied Stocks and Shares

STEADIER conditions have ruled in the stock and share markets on the view that the position in regard to European political affairs has shown improvement. Leading industrial shares attracted some attention and a small part of the recent heavy reaction in values has been regained, although in the majority of cases prices are below those ruling a week ago. Easter holiday influences prevented the volume of business on the Stock Exchange showing more than a small recovery.

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Imperial Chemical ordinary units are 30s. at the time of writing, compared with 29s. 9d. a week ago, awaiting the full results, while the preference shares at 29s. 10½d. have also made a slightly higher price. British Oxygen at 73s. 9d. were better on balance, following publication of the full results, while British Aluminium remained under the influence of the statements at the recent meeting and are a few pence better at 54s. 6d. Lever and Unilever at 35s. 4½d. were 1s. 1½d. higher on balance, although the market remains uncertain whether the impending results will show the maintenance of the dividend at 10 per cent. as the directors' decision may, of course, be influenced by the conditions in Europe where the Dutch associated company has important interests.

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Attention drawn to the large amount of steel and cement required for A.R.P. and similar work assisted sentiment in regard to various shares. Associated Cement were slightly better at 69s. 4½d., while United Steel improved from 23s. 4½d. to 24s., and Dorman Long made the higher price of 27s. 3d. Stewarts and Lloyds and Babcock and Wilcox were fairly steady, awaiting the impending dividend announcements. British Plaster Board 5s. shares were 6d. better at 27s. 3d., the assumption being that the dividend is likely to be kept on a 50 per cent. basis. Imperial Smelting were moderately lower at 9s. 9d., and Borax Consolidated declined 9d. to 22s. 9d. Distillers at 91s. are above the price ruling towards the end of last week, and United Molasses have also improved, business in the latter being around 23s. 6d. at the time of writing. British Oil and Cake Mills preferred ordinary were well maintained at 41s. 3d., and United Premier Oil and Cake ordinary kept at 7s. 9d. under the influence of the past year's results. International Nickel, Swedish Match, "Shell," Burmah Oil and most other shares with an international market were better on balance, although they continued to move rather sharply in accordance with the day-to-day trend of the Stock Exchange.

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Courtaulds fluctuated moderately, but have made the slightly better price of 25s. 3d. at the time of writing. British Celanese issues were steadier, awaiting the forthcoming decision in regard to a dividend on the first preference shares, although a resumption of dividends is not generally expected at this stage. Other rayon shares were also slightly more active on talk of a further increase in rayon prices. Pinchin Johnson were dull at 23s. 9d., but International Paint, Indestructible Paint and various other paint shares were firmer, including Goodlass Wall and Lead Industries which were around 9s. 6d. awaiting publication of the results.

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In other directions Boots Drug were 9d. higher at 41s. 3d. Sangers at 20s. 7½d., British Drug Houses at 22s. 6d., and Timothy Whites at 24s. were little changed on balance for the week. Beecham's Pills deferred shares made the slightly higher price of 6s. 7½d.

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B. Laporte were little changed at 85s. and Greeff-Chemicals Holdings 5s. ordinary units were around 4s. 4½d., while William Blythe 3s. ordinary shares were quoted at 6s., and Monsanto Chemicals 5½ per cent. preference shares at 21s. 10½d. Blythe Colour Works 4s. shares were maintained at 7s. 6d.